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Aero Club of America
RULE BOOK

Including F.A.I. Regulations
(TRANSLATED)



MAR 9 1926



CONTEST COMMITTEE
NATIONAL AERONAUTIC ASSOCIATION
1823 H Street, N. W.
WASHINGTON, D. C.

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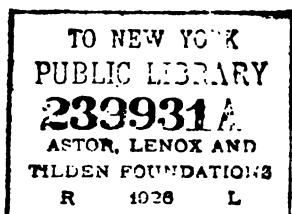


Organization of Aeronautic Contests *and* Contest Rules

Including
**Statutes and General Regulations
of the
Fédération Aéronautique
Internationale**

Price \$2.00

✓ CONTEST COMMITTEE
AERO CLUB OF AMERICA ✓
NEW YORK CITY
1922



Copyright 1922
AERO CLUB OF AMERICA
New York, N. Y.

In Sincere Appreciation

THE PUBLICATION of this volume must be considered an epoch-making event in the development of American Aviation. It marks the beginning of that new era of orderly regulation and control of air sports, exhibitions and contests so beneficial and so necessary to the healthful growth of every phase of this new transportation art.

To give force to the rules and processes herein outlined is one of the duties of the national governing civil body.

Aviation is in its infancy. The men who have labored for months in the preparation of this book, with its translations and heretofore uncompiled tables, instructions and rules, have had little enough of precedent to guide them. Time and practical application and experience will bring many suggestions for change and improvement. These men will be the last to argue perfection or completeness in this present work. But they have made a notable beginning and have laid a foundation upon which we may safely build for the years to come. The contest rules of the A. A. A., which today so well govern motor car contests, have been fifteen years in their making and are even yet subject to minor revisions annually.

A maximum of safety, the cleanliness of sport in contests, and the building of public confidence in the aviation art—all will be materially furthered through this present work.

From the air enthusiast as an individual, from the patriotic American citizen, from our Government and from the aeronautical industry as a whole are due the appreciation and thanks we must always accord to those through whose painstaking energy and accomplishment our people are benefited.

For we now know that in the development of America's air power we have as a nation our greatest insurance against aggression and for the continuance of that state of peace and prosperity we so deeply desire.

Howard E. Coffin.

FOREWORD

THE DEVELOPMENT of the science of flight will depend largely in the future as in the past upon the number and character of aviation contests. It will matter little perhaps whether these competitions for air supremacy are in the nature of World Wars or whether they but register the peaceful rivalries between individuals, between organized groups, or between nations. The aviation meet will bring to this new art that same urge for progress as did the automobile contest in the formative years of motor car industry.

Moreover, our knowledge of the aeronautical science will progress in large degree in proportion to the amounts of money spent on competitions and the general trend of technical development will be influenced by the conditions governing the more important competitions.

The Aero Club has encouraged and must continue to encourage and assist in the development of the science of aviation. Through the generous donations of such men as Robert Collier, James Gordon Bennett, Ralph Pulitzer and Glenn Curtiss, the Club has been able to accelerate aeronautic development by offering valuable trophies and cash prizes for contests, trials, and records which have brought forth new and improved aircraft. As the American member and representative of the F. A. I., the club has assisted by promoting and conducting aviation events and by officiating at sanctioned meets.

However, the field of operations of the club has now broadened. As the uses to which the U. S. Government, the largest individual owner and user of aircraft today, puts its aircraft are comparatively limited, being almost entirely confined to military operations, the manufacturer, finding other market limited, has confined his energies too much to military development. Commercial aviation must be encouraged without delay as the foundation of our system of air defense. Where is the moderate priced commercial plane?

Only as a National Association can the Aero Club give force to the Nation's desire for civil aviation. By encouraging the available financial support it can, as a national body, best further commercial aviation by competitions which will bring forth the commercial airplane, exploit its use, provide the needed aerial highways and terminals, and effect adequate legislation.

The development of the motor car and its usages has been achieved without government support. Receiving in the early stages its first stimulus through the sporting events of the Automobile Clubs of France, Great Britain, America, etc., it passed then into the hands of such powerful organizations as the American Automobile Association, the Automobile Chamber of Commerce and the Society of Automotive Engineers.

Today the Aero Club is in the transitionary stage, passing from the province of a Club to that of an Association. As a national body it will still be fostered

by the Government and called upon by the inventor and manufacturer, but the nation-wide interest in aviation has taken far-flung root and brought within the Club the responsibilities of an association.

Fully cognizant of these conditions the Contest Committee has published this book in keeping with the plan for broadening the field of its operations. Through the election of associate members the Contest Committee will have representation at all aviation centers and will be able to direct all aviation meets, thereby increasing their value, not only as aeronautical events but as direct contributions to aviation, by taking advantage of

(1) Public interest—

- (a) To promote a more intelligent support of aviation as a means of transportation and for national defense.
- (b) To increase the Association's membership.
- (c) To influence adequate legislation.

(2) Official interest—

- (a) To invite the attention of Senators, state and municipal authorities that they may appreciate the interest in aviation of the people of their States and thereby become friendly to legislation and appropriations for aviation purposes.

(3) Publicity—

- (a) To urge the Press to give less prominence to stories of accidents and all "dare-devil" flying.
- (b) To urge and assist in the publication of stories bringing out the practical merits of aircraft and its usages.
- (c) To bring before the capitalist the extent of public demand for aviation, thereby inducing investment in aeronautical development.

(4) Prize money and awards for events which will

- (a) Stimulate the development of aircraft.
- (b) Exploit the uses of aircraft.
- (c) Perfect the art of flying.

The Contest Committee believe that any promoter having a knowledge of the aims of the national body, and the list of owners of aircraft now being compiled for publication, can prepare from the various aeronautical events described in the pages that follow a program for an aviation meet which will not only be best adapted to the number and types of planes in any territory, but also in keeping with the policies of progress and development here expressed.

CALEB S. BRAGG,
Chairman, Contest Committee.

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Judges.

Timers.

Starters.

Scorers.

Police.

Medical.

Publicity.

Representatives of the Aero Club of America.

Contest Committee.

Technical Committee.

Entertainment Committee.

Financial Committee.

Judges' Course Report.

Timer's Sheet (Officials).

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Aero Club of America

Term Expires Nov. 1922

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SECTION ONE

CHAPTER I

SANCTIONS

Sanctions are required for all recognized Aeronautic Events.

Article 7 of the F. A. I. Rules states:

"Everyone participating in the organization of a sanctioned aeronautic meet, and every contestant taking part in a sanctioned aeronautic meet, by so doing agrees

- (1) to know the present regulations thoroughly;
- (2) to submit without restriction to the consequences that result therefrom.

Article 8 of the F. A. I. Rules states:

"All aeronautic events not organized according to these regulations are forbidden; the organizers, the officials, and the contestants in such aeronautic events will be suspended, or disqualified."

The Aero Club of America, as a member of the F. A. I., is delegated with sole authority to grant sanctions in the United States of America, its dependencies, dominions, protectorates or colonies.

Preliminary Requirements for Sanctions

Requests for sanctions must be accompanied by

1. Names, status and addresses of the proposed members constituting a Race Committee, and the office address of the Committee. (Art. 37-38-42-43.)
2. A program of events in accordance with Art. 92, 93, 97, 95, 134. Sample of program of events with rules, etc., will be found on page 36.
3. Description of airdrome (Art. 112-113 and 116) and of terrain (Art. 111).

Temporary Sanctions

Temporary sanctions will be granted after preliminary requirements have been passed upon by the Contest Committee the date fixed and reserved.

Permanent Sanctions

Additional requirements before a permanent sanction can be granted:

1. List of entrants (Art. 44, Par. 1).
List of contestants (Art. 67-68-69-70-71-72-39, Par. 3, and Art. A-19).
2. Names of officials (Art. 36-39-40-44, Par. 2; Art. 45-53).
3. Certified survey of the length of the course; also map. (Art. 142, 143, 196.)
4. Prize money (Art. 93, Par. 6), if offered, must be deposited as Special Fund in Bank or Trust Company.

NOTE:—Three copies of the program must be forwarded if and when printed.

Advantages of Sanctioned Meets.

1. Gives promoters larger list of entries because contestants are assured of:
 - (a) An officially conducted meet; recognition of records; no danger of disqualification. (Art. 8.)
 - (b) Adequate airdromes and suitable course.
 - (c) Prize money being paid.
2. Larger attendance.
3. Better publicity.
4. Co-operation of the club.

NOTE: The Aero Club of America makes no charge for sanctions; however, timers are permitted to charge for their services and the use of instruments. (Art. 65.)

Promoters of Aeronautic Meets or Events should bear in mind that in addition to preparing and conducting the meet, they are required by the F. A. I. Rules to keep a complete record of each event (F. A. I. Rules, Art. 144, 145, 148) and to forward these documents within the time prescribed (F. A. I. Rules, Art. 146) to the Contest Committee of the Aero Club of America and in addition, a written report signed by the officials (F. A. I. Rules, Art. 147) and the report of the Timers (Art. 57-59-60-61-63).

PRIZES. Unless the Deed of Gift provides the manner in which they shall be awarded, prizes are paid to the entrants (F. A. I. Rules, Article 9) but only after the expiration of time prescribed in Articles 152 and 153, but are withheld in event of protest. (Articles 83 and 154) and are forfeited by disqualification under Article 177.

CHAPTER II

VARIOUS KINDS OF AERONAUTIC EVENTS

In organizing an Aviation Meet, the promoters should consider the purpose of each event in order to determine whether they are in a position to conduct the event in a manner which will insure sufficient entries.

The purposes of aeronautic events are classified as follows:

1. **SCIENTIFIC:** Those events stimulating the development of aircraft.
2. **PRACTICAL:** Those events exploiting usages of aircraft.
3. **SPORTING:** Those events formulated primarily to test the skill of the aviator (other conditions being theoretically equal).
4. **RECORDS:** Attempts to establish or break officially recognized records.
5. **PARACHUTES:**
6. **EVENTS TO BE AVOIDED:**

DESCRIPTION OF EVENTS FALLING UNDER EACH OF THESE CLASSIFICATIONS

1. Scientific Events Are Those Conducted:

(a) Under the auspices of the Aero Club of France, Great Britain, Italy, America, etc., to stimulate the scientific development of aircraft and aviation motors, etc., and

(b) Under direct Governmental tests or competition.

Many manufacturers are induced to develop and build special aircraft and enter this type of event, provided regulations and conditions of the event have been laid down in real keeping with the needs of aeronautical development, in which case they will be benefited by:

(a) Their own and their competitors' attempts of solution of the problem or problems offered, or

(b) By the interest taken by the Departments of War in these contests or trials and their results.

(c) By the value of the prize money offered or the advertising value or glory of winning some well known trophy.

(Description of Events Continued on Page 22)



*The
Pulitzer
Trophy*

The Pulitzer Trophy

Provisions of Deed of Gift:

The Pulitzer Trophy, donated by Messrs. Ralph Pulitzer, Joseph Pulitzer, Jr., and Herbert Pulitzer to the Aero Club of America, shall be perpetual and competed for annually by airplanes under rules prepared each year by the Contest Committee of the Aero Club of America, and shall be awarded each year to the Aero Club represented by the pilot of the winning airplane, and this Club shall be entitled to the possession of the trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Pulitzer Trophy, or of assigning this privilege, under sanction, to any other Club or organization.

Gold, silver and bronze plaques will be given by the donors to the pilot winning first, second and third places in every contest for the Pulitzer Trophy.

Winners

1920—Lieut. C. C. Moseley, Verville-Packard Airplane.

1921—Bert Acosta, Curtiss Navy Racer.



Curtiss Marine Flying Trophy

Curtiss Marine Flying Trophy

Donated by Mr. Glenn H. Curtiss in 1911

New Deed of Gift, November, 1921

Provisions of Deed of Gift:

1. The trophy shall be perpetual and competed for annually by seaplanes and flying boats.
2. The contest shall be in the nature of a race either around a closed circuit or from point to point. The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.
3. The trophy shall be awarded each year to the Aero Club represented by the pilot of the winning machine, and this Club shall be entitled to the possession of the trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Curtiss Marine Trophy, or of assigning this privilege, under sanction, to any other Club or organization.

Under Former Deed of Gift, awarded in:

- 1915—Oscar A. Brindley, U.S.A., A.C.C.
- 1916—Victor Carlstrom, A.C.A.
- 1917—Caleb S. Bragg, A.C.A.
- 1918—Lt. Thomas C. Rodman, U.S.N., A.C.A.
- 1919—Dave H. McCulloch, A.C.A.



*Upper Third Only of
Liberty Engine Builders' Trophy*

The Liberty Engine Builders' Trophy

Provisions of Deed of Gift

1. The trophy shall be perpetual and competed for annually by observation type (2-passenger) airplanes.
2. The contest shall be in the nature of a race either around a closed circuit or from point to point. The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.
3. The trophy shall be awarded each year to the United States Air Service, or to the Embassy in this country of the foreign Air Service, represented by the pilot of the winning machine. This Air Service or Embassy shall be entitled to the possession of this trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Liberty Engine Builders' Trophy, or of assigning this privilege, under sanction, to any other Club or organization.
4. Gold, silver and bronze decorations will be given to the pilot winning first, second and third places in every contest for the Liberty Engine Builders' Trophy.



Collier Trophy

The Collier Trophy

Provisions* of Deed of Gift:

The Collier trophy, donated by Robert J. Collier, Esq., to be awarded annually by the Aero Club of America for the greatest achievement in aviation in America, the value of which has been thoroughly demonstrated by the actual use during the preceding year.

Awarded in:

1911 to Mr. Glenn H. Curtiss for hydro-airplane development.

1912 to Mr. Glenn H. Curtiss for development and demonstration of the flying boat.

1913 to Mr. Orville Wright for development and demonstration of his automatic stabilizer.

1914 to Mr. Elmer A. Sperry for development and demonstration of gyroscopic control.

1915 to Mr. W. Starling Burgess, for development and demonstration of Burgess-Dunne hydro-aeroplane.

1916 to Mr. Elmer A. Sperry for development and demonstration of Sperry Drift Set.

This trophy was not awarded from 1917 to 1920 on account of the war.

In 1921 to Grover C. Loening, Esq., for development and demonstration of his aerial yacht.

The following trophies and cash prizes have been offered for events classified as scientific:

BRITISH: Circuit of Britain, £10,000 offered by London Daily Mail.

London Daily Mail offered £10,000 for Trans-Atlantic flight.

British Government offers £50,000 prize for Helicopter flights.

FRENCH: Coupe Henry De La Meruthe, with 200,000 francs prize money for airplane.

The Jacques Schneider Marine Aviation Cup for seaplanes or flying boats.

New Michelin Cup (100,000 francs).

The meeting at Monte Carlo (seaplanes and flying boats) for large cash prizes offered by the principality of Monaco.

ITALY: Governmental contests for cash prizes totaling 400,000 lire.

AMERICA: Pulitzer Trophy for Airplanes.

The Curtiss Marine Trophy for seaplanes or flying boats.

The Liberty Engine Builders' Trophy.

The Collier Trophy

Thos. Ince's offer of \$50,000 for the first Trans-Pacific flight.

* * * *

In this country the races for the Pulitzer Trophy and the Curtiss Marine Trophy shall only be attempted in communities where financial support can be received from the business men or concerns in the city, as there is no direct financial return adequate to meet the expenses and the large amount of prize money which should be awarded in keeping with these events, although a certain return can be obtained from programs, grandstand and reserve parking space, provided the paying occupants of these places will receive real information during the progress of the race. Therefore, these races should only be attempted where the return will benefit the business man who advances the money to make the meet possible; in other words, the race should be used as an attraction during the World's Fair or to prolong or make more attractive some large Convention: or for

the advertisement or expression of patriotism of the Board of Trade or other organization in any large city.

Furthermore, under the present regulations which are intended to develop a greater useful speed in aircraft, the Pulitzer Trophy Race can only be held upon a very large and specially smooth airdrome with ample hangar facilities which practically eliminates anything in this country except U. S. Governmental aviation field, unless a special field is prepared by some municipality and inaugurated with this event.

2. Practical Events

TROPHIES: Detroit Aviation Country Club Trophy.
Detroit News Aerial Mail Trophy.

Practical Events are those conducted under conditions which permit the entry of existing aircraft; the object of these events being to arouse the interest of the owner or user of aircraft and of the other persons interested in aviation. This type event is as follows:

1. Prizes offered for cross country flights to any city where a meet is to be held for airplanes entered in other events held during the meet, and awarded for the greatest number of points obtained by multiplying the distance flown by the flying time expressed in miles per hour (the average speed). Each contestant should be required to submit a truthful statement of his flight and flying times duly signed and witnessed before a Notary Public.

2. Prizes offered for the best completed demonstration of Aerial transportation to or from the city holding a meet, by airplanes (and seaplanes) if possible, within any eight hours starting at () a. m. and finishing at () p. m. The airdrome is arbitrarily considered as being within the city limits (corresponding to railroad station) for times, etc., in this event.

Contestants shall notify the Contest Committee of their intention to enter, and give name of airplane, motor and pilot. The exact nature of each contestant's contemplated trip should be sent in a sealed envelope, which will not be opened until after the entries have closed (entries close, give date). This will insure entrants against having their ideas stolen or copied, but will give time to have the proposed trips printed in the program and newspapers.

Each contestant should explain fully the object of his proposed trip, and in some manner point out its merits; for example, its advantages over other known means of transportation, or the



Aviation Country Club of Detroit Trophy

The Aviation Country Club of Detroit Trophy

Provisions of Deed of Gift:

1. The trophy shall be competed for annually by light commercial airplanes until it has been won three times by the same entrant or pilot of the winning planes. In the event that the same entrant and pilot win together three times, then the trophy shall go to the entrant.

2. The contest shall be in the nature of a race either around a closed circuit or from point to point. The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.

3. The trophy shall be awarded each year to the entrant of the winning machine (until permanently won by entrant or pilot as outlined in paragraph 1). This entrant shall be entitled to the possession of the trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Aviation Country Club of Detroit Trophy, or of assigning this privilege, under sanction, to any other Club or organization.



Detroit News Aerial Mail Trophy

The Detroit News Aerial Mail Trophy

Provisions of Deed of Gift:

1. The trophy shall be perpetual and competed for annually by multi-motored airplanes capable of carrying a pay load of 800 lbs. or over.
2. The contest shall be in the nature of a race either around a closed circuit or from point to point. The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.
3. The trophy shall be awarded each year to the entrant of the winning machine. This entrant shall be entitled to the possession of the trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Detroit News Aerial Mail Trophy, or of assigning this privilege, under sanction, to any other Club or organization.
4. Gold, Silver and Bronze plaques will be given to the pilot winning first, second and third places in every contest for the Detroit News Aerial Mail Trophy.

possibilities of air travel which other known means of transportation do not offer; or the increase in the value of properties reached by air, which are of comparatively small value, due to existing transportation conditions; or the health giving and building opportunities of daily change of air and altitude, etc. etc. These conditions should be measured in time, either time saved, or lengthening of the working or recreation day; or in dollars and cents as represented by reduction in cost, or increase in values; or some other comparable form to assist the Judges in making their decision.

The Judges shall be the Aviation Editors of the local newspapers, and the trophy shall be awarded on points as follows:

Each Editor shall publish in his paper his choice for the first five planes, and in each published list the Contest Committee will award 5 points for first place, 4 points for second place, 3 points for third place, 2 points for fourth place, and 1 point for fifth place. The contestant receiving the greatest number of points shall be awarded the trophy. However, no contestant shall be eligible for the trophy unless the proposed flight is actually completed.

It is believed that this event will have considerable value, as the aviation editors will publish a considerable amount of material on the various merits of the use of airplanes, and the advance publication of the proposed trips of the contestants will bring the various uses to which the airplane may be placed before the public in an interesting form.

3. Prizes may be offered for the best completion of aerial transportation between any two points of interest with passenger carrying or parcel delivery, etc., etc., conditions. This event will be more satisfactory to contestants and others interested if divided into various classes, to include the majority of the types of airplanes which may be expected to compete. This classification should be based upon the amount of gasoline consumed rather than the horsepower; or open to standard makes of airplanes equipped with given motors, rather than any arbitrary formula.

4. Performance flights and demonstrations in connection with outdoor aero shows.

3. Sporting.

Sporting Events are those which are primarily a test of the skill of the aviator, other conditions being theoretically equal, are as follows:

1. RACES in which the airplanes are classified by the gasoline consumed rather than the horsepower of the motor, or open to standard makes of airplanes equipped with given motors.
2. HANDICAP RACES, in which the handicaps are awarded upon the performance of the aviator in at least two other races.
3. RELAY RACES, in which a pilot must bring his plane to stop over a given spot on the field before his team-mate may start.
4. AERIAL DERBY: Aerial Derby (with the name of the city prefixed) is the name arbitrarily given to a race in which all contestants compete for the principal prize, but in addition some may compete for class or invitation prizes at the same time.

Prizes should be offered for class races where there are four or more eligible entrants for any class (class rules will be found under "General Rules to be published for all meets or races").

Class races can only be announced and contestants placed in them by the Contest Committee, after the entries for the Aerial Derby have closed when the numbers of various types of airplanes are known to the Contest Committee.

Prizes should be offered for invitation races in which airplanes evenly matched in the opinion of the Contest Committee, but not eligible for class races under the class race rules, may be invited to compete.

In starting an aerial derby the classes should be started separately and all contestants in any one class or invitation race should be sent away together; the faster races should be started before the slower. The remaining airplanes not eligible for class or invitation races should be sent away after the classes and invitation races have been awarded.

An Aerial Derby should be made the principal event in an Aeronautic Meet as it gives all contestants the opportunity of being in the air on the most important day, and furthermore, it gives most of the contestants (those eligible for class or invitation races) an opportunity of having a good race although their planes may not be fast enough to win the Derby.

5. MILITARY GYM KHANA: The following events are being prepared by the Aero Club of America for the Military Events of the United States Government Air Services, and should be scheduled at meets where a large number of reserve aviators may be expected to enter.

(a) **AERIAL COMBAT:** Combat in single seater airplanes of the same model or as equally matched as possible. All contestants shall meet every other contestant in aerial combat and the trophy awarded on the percentages of the number of combats fought, won and lost. Each victory will be decided by the number of hits registered by a gun camera (these may be borrowed from the Army Air Service) in a given length of combat time—five minutes.

(b) **PHOTOGRAPH RACES:** Contestants will be started over a triangular or rectangular course and all required to photograph en route certain designated areas (at least two) which should be specially marked during the time of the race to prevent substitution of photographs taken previously.

Prizes are to be awarded on points given as follows:

(b1) To the Winner of the Race: i.e., the aviator who completes the full course in the shortest elapsed time, having taken the required photographs—600 points. To those finishing within twenty minutes of the winner their pro rata share of points on the basis of a loss of thirty points per minute late.

(b2) For the Largest Photograph: A contestant may receive 300 points. The size of the photograph of the prescribed area is determined by the proportion of the negative covered by this area. For example, a negative completely covered by the prescribed area shall be considered 100% as to size and the contestant awarded 300 points.

A negative only half covered by the prescribed area shall be considered 50% as to size and the contestant is awarded 150 points. Note that the size of the negative has nothing to do with the size of the photograph, as the points are awarded proportionately to the amount of negative covered.

(b3) For the Clearest Photograph: A contestant shall receive 300 points, and other contestants shall receive their proportion of points based upon the percentage of clearness of their photographs, according to the general practice of grading for this type of photography.

(c) **BOMBING CONTESTS:** Contestants shall be started over a triangular or rectangular course and all required to drop a certain number of bombs upon certain predetermined targets.

Prizes are to be awarded on points given as follows:

(c1) Bombing Contest: To the winner of the race, i.e., the aviator who completes the full course in the shortest elapsed time, having dropped the prescribed number of bombs upon each of the targets—600 points. To those finishing within twenty minutes of the winner their pro rata share of points on the basis of a loss of thirty points per minute late.

(c2) For Bomb Dropping: 600 points may be won by any contestant for perfect bomb dropping. The 600 points to be awarded shall be divided by the number of bombs carried and the resultant number of points per bomb given for each hit. Example: ten bombs carried is equivalent to 60 points per bomb, therefore, nine hits gives the contestant 540 points.

(c3) Mackay Army Trophy: The Mackay Army Trophy presented by Mr. Clarence Mackay, a member of the Aero Club of America, to be competed for annually by officers of the United States Army. (See pages 32-33.)

4. Records

Officially recognized world's records are described in another part of the book. Record trials should not be included in the programs of ordinary aeronautic meets, as the breaking of present world's records require weeks and sometimes months of preparation, while the attempts proper are confined to almost ideal weather conditions, and furthermore, are of little interest from the spectacular standpoint.

5. Parachutes.

Performance tests for parachutes should be based on:

1. The length of time the parachute takes to open after leaving the airplane.
2. Its landing speed, and
3. Consideration given the lightest weight and most compact or adaptable size when folded.

The test of skill in handling a parachute consists in landing nearest a mark and not in jumping out at the greatest altitude.

NOTE: The ability of the pilot to leave the airplane during various maneuvers such as tail spins, etc., is of considerable importance, but at this time we recommend leaving tests of that nature to the Government.

Events for parachutes with adequate prizes should be encouraged as the parachute will in the future be the means of saving many lives.



Mackay Army Trophy

The Mackay Army Trophy

The Mackay Army Trophy presented by Mr. Clarence Mackay, a member of the Aero Club of America

Provisions of Deed of Gift:

To be competed for annually by officers of the United States Army under rules to be made each year by the War Department of the United States Government, or in the absence of a contest, this trophy may be awarded annually by the War Department to the officer or officers who in their opinion make the most meritorious flight of the year.

This trophy was awarded in 1912 to Lieutenant Henry H. Arnold.

In 1913 to Second Lieut. Joseph E. Carberry, pilot, and Second Lieut. Fred Seydel, observer, reconnaissance flights.

In 1914 to Captain Townsend F. Dodd and Lieut. Fitzgerald, observer, reconnaissance flights.

In 1915 to Lieut. Byron Q. Jones, duration flights.

In 1916 and 1917, the trophy was not awarded on account of the war.

In 1918, Captain Edward V. Rickenbacker, officially credited with 26 enemy airplanes.

In 1919, to Lieut. Belvin W. Maynard; Lieut. Alexander Pearson, Jr.; Lieut. R. S. Northington; Captain John O. Donaldson; Captain Lowell H. Smith; Lieut. Colonel Harold E. Hartney; Lieut. E. M. Manzelman; Lieut. R. G. Bagby; Lieut. D. B. Gish, and Captain F. Steinle for their flight from Atlantic to Pacific and return.

In 1920, to Captain St. Clair Street, commanding officer of the Alaskan flying expedition; First Lieut. Clifford C. Nutt, Second Lieut. Eric H. Nelson, Second Lieut. C. H. Crumrine, Second Lieut. Ross C. Kirkpatrick, Sergt. Edmond Henriques, Sergt. Albert T. Vierra, Sergt. Joseph E. English for their flight from New York to Nome, Alaska, and return.

In 1921, to Lieut. B. J. S. Macready, World's Altitude Record.

AERO CLUB OF AMERICA RULE BOOK

Events to be Avoided.

1. RACES requiring passengers to be carried; the option of weight equivalent should always be given for the following reasons:

(a) While legitimate flying with throttle motor is about 90% free from motor trouble and forced landings, the same planes flown at full throttle as is generally done in a race are about 50% free from mechanical troubles and forced landings.

(b) In legitimate flying the pilot should fly at sufficient altitudes to give him an opportunity to pick a good landing field in case of mechanical trouble, but in a race the pilot cannot afford to waste the time necessary to climb 3,000 to 4,000 feet and therefore in case of motor failure has far less opportunity of making a successful landing.

2. RACES, the results of which are determined by formulae as all formulae are arbitrary, and therefore, have questionable value. Furthermore, the difficulty of taking the necessary measurements before and after the competition to satisfy the conditions of the formula may require more effort than the results would justify. These races lack spectacular interest as none of the spectators know who the winner is until the following day.

3. PROFESSIONAL AERIAL ACROBATICS: Such performances as wing-walking, plane changing, etc., by professionals will not be allowed at a sanctioned meet as the Contest Committee of the Aero Club of America feel that this type of performance with the publicity given it by the manager of the exhibitors or their press agent, is not in keeping with the best interests for the development of aviation.

We do concede, however, that many of these airmen give marvelous demonstrations of skill in aerial acrobatics, the importance of which in aerial combat cannot be overestimated, and therefore all military aviators receive a full course of instruction in acrobatics.

CHAPTER III

RULES FOR AERONAUTIC CONTESTS

Program of Events.

The program of events must contain the following information, which must receive the approval of the Contest Committee of the Aero Club of America before publication:

- (a) Place, date and time of events and of the closing of entries.
- (b) A list of events and the prizes for each event.
- (c) The rules and general regulations governing each event.
- (d) The members of the Race Committee, President, other officers and directors, and at least the Chairman of the following Committees:

- Financial (Prize Fund) Committee
- Contest Committee
- Technical Committee
- Publicity Committee
- Reception and Entertainment Committee
- Field Course and Supply Committee
- Referees
- Judges
- Timers
- Starters
- Scorers
- Police
- Medical

Promoters about to prepare a program of events will find on the following pages, examples of all the necessary rules, also optional rules in their regular order. These rules have been prepared by the Contest Committee of the Aero Club of America for other contests and therefore should need no correction.

The following information for all events should be printed and distributed with the entry blanks. The headings to the side under Information are the various conditions of the contest which must be determined in advance, and approved for sanctions; and under the word Examples are examples of the rules which have already been drawn up and approved by the Contest Committee of the A. C. A. for various races and events. If closely followed no corrections will be necessary. In many instances several suggestions and alternates are given.

INFORMATION**EXAMPLE****EVENT No. 1****NAME OF EVENT→**

Detroit Aerial Water Derby

Including

NAME OF TROPHY→

Curtiss Marine Flying Trophy

DATE→

SATURDAY, OCTOBER SEVENTH

*Cash Prizes***CASH PRIZES→**

First Prize	\$1,200.00
Second Prize	600.00
Third Prize	200.00
Total.....	<u>\$2,000.00</u>

NATURE OF RACE→

**FREE-FOR-ALL RACE FOR
FLYING BOATS and SEAPLANES**

DEED OF GIFT→

**PROVISIONS OF NEW (1922) DEED OF GIFT FOR
CURTISS MARINE TROPHY:**

1. The trophy shall be perpetual and competed for annually by seaplanes and flying boats.
2. The contest shall be in the nature of a race either around a closed circuit or from point to point. The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.
3. The trophy shall be awarded each year to the Aero Club represented by the pilot of the winning machine, and this Club shall be entitled to the possession of the trophy until one month prior to the next

succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Curtiss Marine Trophy, or of assigning this privilege, under sanction, to any other Club or organization.

CONDITIONS→

1. CONDITIONS OF CONTEST:

(Examples)

(a) Factor of safety—

Monoplanes—6 as loaded for start of race.

Biplanes —4 as loaded for start of race.

(b) Air speed greater than 70 miles per hour, as loaded for start of race.

(c) Arranged to seat three or more passengers, including pilot, and carrying their capacity load; 160 lbs. of ballast must be carried in place of each passenger omitted.

(d) Carrying contracted, specified or advertised loads.

(e) Gasoline consumption for race limited to _____ gallons.

(f) Visibility and maneuverability (water and air) which in opinion of Contest Committee, Detroit Aviation Society, is not a menace to the other contestants or spectators.

COURSE→

2. DISTANCE:

(Note: Use of Balloon in Course optional, attaching streamers to anchorage cable obligatory)

Approximately 240 miles—six times around a closed course of approximately 40 miles, starting at Selfridge Field, passing over captive balloon located approximately 10 miles west at about 3,000 feet altitude, thence to northwest turn, thence to Packard Field, and then returning to Selfridge Field.

STARTS→

3. (a) START:

The starting signal will be given at 3 p. m. Planes to be in their allotted places at 2 p. m. Pilots' meeting for the final instructions to be announced later.

(b) POSITION AT START (Flying Start):

Planes competing for Pulitzer Trophy will be sent away separately in the order of the receipt of entries.

(c) METHOD OF START (Flying Start):

Starting time will be taken when plane crosses starting line between marks defining this line.

(d) No contestant shall start before he receives the getaway signal.

(e) Any contestant, having once started, cannot receive another start. However, he may complete the race, if forced down, provided he can do so before 5:30 p. m.

(b) POSITION AT START: (Standing Start)

Planes competing for the Aviation Country Club of Detroit Trophy will be sent away together in a flight, or series of flights, dependent upon the number of entrants and the conditions at the time of start. However, any entrant will be permitted to start alone after all flights if this request is made to the Contest Committee in writing before Oct. 9th, 1922.

(b) POSITION AT START: (Aerial Derby)

Planes competing for class and invitation prizes in addition to Curtiss Marine Trophy will be sent away together in a class, the faster classes starting before slower. Competitors for Curtiss Marine Trophy only will be sent away together after the classes.

(c) METHOD OF START:

(Standing Start or Aerial Derby)

The Starter will assign an Assistant Starter to each plane, who shall raise the signal flags to and for its pilot as follows: The starting signal (for motors only), a red flag, will be raised by the Chief Starter at 1:45 p. m. When the motor of each plane is running the Assistant Starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 2:00 p. m., the Starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the blocks from under the wheels. Each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his Assistant Starter will not raise the red flag, but, when the Chief Starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however,

it may complete the race, though forced down, provided it can do so before 5:30 p. m.

(c) METHOD OF START:

(Standing Start for Seaplanes or Aerial Water Derby)
Contestants will be lined up along the shore in shallow water for the start. The Starter will assign an Assistant Starter to each plane who shall raise the signal flags for its pilot, as follows: The starting signal (for motors only), a red flag, will be raised by the Chief Starter at 2:45 p. m. When the motor on each plane is running, the Assistant Starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 3:00 p. m., the Starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds; each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his Assistant Starter will not raise the red starting flag, but, when the Chief Starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be started after a delay of two hours. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before 5:30 p. m.

(c) METHOD OF START:

(Standing Starts for Seaplanes in Deep Water)

When conditions do not permit standing starts in shallow water, seaplanes shall taxi up to the starting line at their appointed time and fully throttle their motor to the satisfaction of the Starter, who shall then raise a red flag which is a signal to the seaplane to proceed across the starting line at no greater speed. When the seaplane crosses the starting line, the Starter shall give the getaway signal by raising a white flag. However, should the Starter not be satisfied with the speed of the seaplane when it crosses the starting line he shall raise a blue flag which signifies an irregular start and the seaplane will be required to return and try another start.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks indicating

TIMING→

this line, after having completed the full course, approximately 240 miles.

**DETERMINING
THE WINNER→**

5. WINNER:

Of first place shall be the pilot who has completed the full course in the shortest elapsed time, and of each second place the second best time, etc., provided the pilot is not disqualified. The Liberty Engine Builders' Trophy will be awarded to entrant of winning airplane, and the prize money paid to the entrant of the winning airplane. Agreements between pilots and entrants as to their proportional share of the prize money will be upheld by the Contest Committee, who will pay the prize money in accordance with agreements in writing between pilots and entrants, presented to the Contest Committee prior to the race, or within twenty-four hours after the finish of the race.

**VIATORS'
LICENSE→
REQUIRED**

6. QUALIFICATIONS:

No airplane may take part in the contest unless it is piloted or commanded by a pilot, who must be on board and who must be furnished with a license issued by the Contest Committee of the Aero Club of America. (F. A. I. Rules, Art. 67.) Every person furnished with Pilot's certificate of any Government or F. A. I. may obtain license issued optionally by Contest Committee, Aero Club of America. (F. A. I. Rules, Art. 70.) A license will be valid until the 31st December of the current year.

PENALTIES→

7. DISQUALIFICATIONS:

"All infractions of the F. A. I. regulations or of the regulations adopted by the Contest Committees of the National Federations or of special regulations approved for any special event, committed by organizers, officials, contestants, pilots, etc., are liable to the penalties prescribed by the F. A. I., or by the National Federation and imposed by the Contest Committees of the National Federation, or of their authorized delegates. Art. 155." (F. A. I. Rules.)

"Everyone participating in the organization of a sanctioned aeronautic meet, and every contestant taking part in a sanctioned aeronautic meet, by so doing agrees (1) to know the present regulations thoroughly; (2) to submit without restriction to the consequences that result therefrom. Art. 7." (F. A. I. Rules.)

**RULES FOR
CONTESTANTS→**

8. RULES OF THE RACE:

(First Five Are Essential)

(1) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(2) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(3) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the Field, and land in that part of the Field assigned for landing and in so doing shall not cross the course or finish line.

(4) Pilots shall pass all turning points in plain view of the observing officials stationed at each turning point and at an altitude of not over 500 feet.

"Contestants in making a turn must pass completely outside the pylons taking them always on the same hand which will be indicated by the rules."

"In order that aircraft may be credited with having rounded a pylon, it must have completely traversed the line bisecting the angle of this pylon and its vertex."

"In the case of open or closed circuits with re-entrant angles, contestants will be required to turn the pylon on the side of the vertex of the angle."

FOULING MARK:

"Any competitor who has failed to turn a pylon properly may validly continue on the circuit provided he makes a complete turn of the said pylon and then continues his course in the proper direction." (F. A. I. Rules 114, 140, 115.)

(5) No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Anti-knock fuels may be used.

(Rule six necessary when captive balloon is placed on course.)

(6) Pilots must attain the altitude of the captive balloon each lap, and in passing shall do so to either side in order that the observers in the basket may clearly see the airplane's number. Any pilot not having sufficient altitude upon reaching the

shall continue to climb, but must make a circle so that when passing the balloon the second time the airplane will be headed in the line of flight of the course.

(Rule seven necessary when standing start is used.)

(7) No contestant shall start before he receives the getaway signal.

(Rule eight necessary when standing start for more than one airplane is used.)

(8) Upon receiving the getaway signal for the start, pilots shall hold a straight course and not cross or attempt to cross in front of the planes on either side.

(Rules nine, ten and eleven necessary if water controls are one of the conditions of a race for seaplanes.)

**WATER
CONTROLS→**

(9) From a standing start contestants will fly around the first four laps of the course, and during laps 5, 6 and 7 will be obliged to alight on the water and while running along the surface of the water enter into and pass through, in the proper direction, the water controls which shall be designated by moored markers on both sides.

NOTE: There will be only one water control in the shape of a hairpin turn. The entrance into and exit from this control will be located sufficiently near the turning mark that anything but normal landing speeds or normal taxiing speeds will overrun the turning mark and result in loss of time.

(10) While within the markers bounding the water controls, the contestants must maintain constant contact between the water and fixed surfaces of the principal flotation gear (wing or tail pontoons, or water rudder, or any other adjustable, movable or flexible attachment is not sufficient contact with the water, under this rule).

(11) Within the water controls, both planes being on the water, the overtaking plane must pass to the right and all mechanics of competing planes must look to the rear and warn pilots of an overtaking plane. Pilots of overtaken planes must keep to the left and give the faster, overtaking plane room to pass on the right.

**TIME ALLOWED
FOR PROTESTS→**

9. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of Detroit Aviation Society within twenty-four hours after the finish of the race. (F. A. I. Rules 78, 79, 80.) (Appeals. See F. A. I. Rules, Art. 178-179.)

**MARKINGS ON
AIRCRAFT→**

10. NUMBERS:

Each plane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of

lower wing and on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering over twelve inches in height.

11. ADVERTISEMENTS:

"Competitors are forbidden to display on their apparatus or material any commercial advertisement except the trademark of the constructor of the apparatus." (F. A. I. Rules, Art. 89.)

NUMBER OF
ENTRANTS→
REQUIRED

12. NUMBER OF CONTESTANTS:

Minimum number of contestants FOUR. (A. C. A. Rule 201.)

Maximum number of contestants TWENTY-FIVE. (F. A. I. Rule 110.)

SPECIAL
RACES→

13. ADDITIONAL PRIZES: (Optional Awards)

Additional prizes will be awarded for Class or Invitation races to be announced by the Contest Committee of the Detroit Aviation Society after entries have closed.

(a) CLASS RACES:

Four or more planes of the same design and equipped with the same motor shall constitute a class.

CLASS RULE:

Planes eligible for class races are those constructed under the same design and general specifications and not altered to materially change these specifications, nor to prevent the interchange of any corresponding part or parts of any two planes.

Furthermore, should any interchange of corresponding part or parts be directed under this rule, the plane must remain the same after the interchange from the standpoint of design and operation.

EXCEPTIONS:

Stream-lining which does not alter the structure of the part or parts stream-lined.

Motors eligible for class races are determined by the above rule and these exceptions: Any make or design of propeller, ignition, spark plugs, carburetor, including intake manifold, exhaust manifold, gasoline and oil systems may be used.

(b) INVITATION RACES:

The Contest Committee of the Detroit Aviation Society may invite any of the entrants to compete for a special prize.

(c) FOR SEAPLANE RACES IF WATER CONTROLS ARE USED:

The (to be announced later) prizes for greatest air speed will be awarded to the contestant who, during the Curtiss Marine Trophy race, completes laps 2, 3 and 4 in the shortest total elapsed time. (The first lap is not included because of the standing start.)

**DATES OF
ENTRIES AND→
FEES**

Entries

Free entries close Aug. 1, 1922. 25 per cent penalty entries close Aug. 8, 1922. 50 per cent penalty entries close Aug. 15, 1922.

The entry fee, \$100.00, will be refunded if the contestant is in his allotted place ready to start in the contest, provided the entry is received before August 1. Entries received after August 1, but prior to August 8, will be penalized \$25.00. Entries received after August 8, but prior to August 15, will be penalized \$50.00. After August 15 entries will only be accepted with the written consent of all other entrants and the entry fee of \$100.00 will not be refunded.

**PRIZES
AWARDED ON→
POINTS**

OPTIONAL TRIALS AND AWARDS.

Where the performances of airplanes are of considerable importance or interest, contests may be conducted in which the winner is determined by points awarded for winning or placing in the race and also for trials. Examples of trials which may be held in connection with a race are listed below.

14. CONDITIONS OF TRIALS:

Trials for slow speed landing, take-off and greatest range of speed—also the examination for bonuses given for self-starter, muffler and accessibility to: Oil, water, gas filling caps, draining plugs and filtering screens; ignition breakers and distributors, will be conducted from October 5th to 10th, 1922.

15. Any contestant failing to make these trials during this period shall, at the discretion of the Contest Committee, forfeit the rights to the points which he may have gained—even though the trials are made after the race.

16. This trophy and cash prizes are to be awarded on points, given as follows:

(a) To the winner of the race proper.....600 points
To those finishing within twenty minutes of the winner their pro rata share of points on the basis of 30 points per minute.

(b) For the greatest range of speed.....250 points
The time to be figured by deducting the time it would take the airplane to fly one-quarter of the distance of the race at its lowest speed (this to be determined in advance by trial flights in both directions over a measured course with throttled motor) from the time in which the airplane actually completed the race. To those coming within fifteen minutes of the speed range winner, their pro rata share of points on the basis of 16.66 points per minute.

(c) For the shortest take-off.....100 points
To those taking-off within 100 feet of the winner, their pro rata share of points on the basis of one point per foot.

(d) For the shortest run after touching wheels when landing100 points
To those stopping within 100 feet of the winner, their pro rata share of points on the basis of one point per foot.

(e) A bonus of fifty points will be given to each airplane carrying an operative self-starter.

(f) A bonus of fifty points will be given to each airplane carrying a muffler which effectively muffles the motor at a height of 1500 feet, in normal flight.

(g) For the greatest speed (over kilometer course)100 points
For speeds within twenty miles of the greatest speed, 5 points per mile.

(h) For the greatest altitude or preferably for the quickest climb to 10,000 or 15,000 feet....100 points
With the proportional number of points to those coming within certain time, or altitude in feet of the winner.

(i) A bonus of 50 points will be given to each airplane having complete accessibility to the following: Oil, water, gas-filling caps and drain plugs.

(j) A bonus of 100 points will be given to each airplane having complete accessibility to the following: Spark plugs, oil and gasoline screens, ignition breakers and distributors, and carburetors in respect to both adjustment and inspection.

NOTE: The total number of points which may be won in the trials may equal, but should never exceed the number of points given for first place in the race.

NOTE: Any airplane failing to complete the race is not entitled to the points given for range of speed, as the element of reliability is embodied in this event.

In the event of a tie in the scores of two airplanes, the airplane having received the greatest number of points in the race shall receive an extra point.

SUGGESTED FORM OF ENTRY TO BE PRINTED IN RULES AND ENTRY BLANK FORM

To the Contest Committee of
The Detroit Aviation Society, Inc.,
4612 Woodward Avenue,
Detroit Michigan:

I, the undersigned, hereby make entry as a participant in the contests to be held by the Detroit Aviation Society, Inc., Oct. 7, 12, 13, 14, 1922, and I transmit herewith my entry fee of one hundred dollars (\$100). (Government entries accepted without entrance fee.) This entry being made upon the following conditions:

1. This entry shall not be effective until acceptance by the Contest Committee.

2. It is understood that my deposit of one hundred dollars (\$100) shall be returned to me if this entry is not accepted, or, if accepted, if and when my airplane is on the field ready to start, the morning of the contest. (Late entries subject to published penalties, page)

3. I hereby agree to abide by the rules of the contest, which are part of this entry form, and the matters not covered thereby shall be subject to the rules and regulations of the International Aeronautical Federation, which I hereby obligate myself to know under F. A. I. Rules, Art. 7, which states: "Everyone participating in the organization of a sanctioned aeronautic meet, and every contestant taking part in a sanctioned aeronautic meet, by so doing agrees (1) to know the present regulations thoroughly; (2) to submit without restriction to the consequences that result therefrom," and also such special rules as may be made by the Contest Committee of the Detroit Aviation Society, Inc., and to enforce compliance therewith by my agents, servants and representatives.

4. Rules, announcements or notices sent to me or my pilot shall be deemed properly addressed if directed in accordance with addresses given herewith, and in the entry book. (F. A. I. Rules, Art. 96.)

5. That the decision of the Contest Committee of the Detroit Aviation Society, Inc., shall be final and binding upon me, my servants and representatives (See F. A. I. Statutes A-31), subject my right of protest F. A. I. Rules 78, 79, 80, 81 and Appeals 178, 179.

6. I assume and accept full responsibility and agree to indemnify and save harmless the promoters and managers of the contest for any damage to persons or property caused by myself, my agents, servants or representatives, or arising from the operation, storage or maintenance of my machine, both during the continuation of the contest and during any period that I or my servants shall be using the field, or surrounding country, for trials or training purposes.

7. I agree that I shall abide by the decision of the Technical Committee Detroit Aviation Society, Inc., as to the factors of safety of my airplane entered in this contest, and to have it flown over a measured course to determine its air speed, in case the Contest Committee shall so request.

8. I agree, if required, to abide by the decision of the physician appointed by the Contest Committee as to the physical fitness of myself or pilot to compete in this contest.

9. I agree, to furnish the Contest Committee of the Detroit Aviation Society, Inc., with all technical information regarding my airplane they may desire.

Date.....

Signed

Address

Entries close August 1, 1922. Entries received subsequent to August 1, 1922, shall only be accepted in accordance with conditions printed on page 3 thereof. If this entry is accepted, entrants and pilots will be forwarded a copy of this form and F. A. I. rules.

**SUGGESTED FORM OF ENTRY TO BE PRINTED IN
RULES AND ENTRY BLANK FORM**

- Event No. 1—Detroit Aerial Water Derby and Curtiss Marine Flying Trophy.
Event No. 2—Detroit News Aerial Mail Trophy.
Event No. 3—Aviation Country Club of Detroit Trophy.
Event No. 4—Liberty Engine Builders' Trophy.
Event No. 5—Pulitzer Trophy.

(Mark Event in which you wish to enter)

ENTRY BLANK

Event No.....

Name of Entrant.....

Address

Make and Type of Airplane.....

Make and Type of Motor, including H. P.....

*Factor of Safety, as Loaded at Start of Race.....

Speed, as Loaded at Start of Race.....

Name of Aviator.....

Address

Origin (Army, Navy, Aero Club, etc.) of Aviator's Certificate.....

Name of Aero Club which Pilot Represents in the Contest.....

.....
*Unnecessary for airplanes approved for governmental use by any recognized Government, or 1920-1921-1922 Gordon-Bennett models.

Number Assigned

Date Received

Please answer the following questions as early as possible:

1. What Hangar Area will you Require?.....

2. How many Mechanics will you want to Quarter on the Field?....

3. Between what Dates will Mechanics be quartered?.....

4. How will your Airplane Reach the Field and about what date?....

.....

GENERAL INFORMATION.

If the Entry Blank contains the following "General Information" it will eliminate considerable correspondence:

1. Location of airdrome, i. e., distance from city, highway, street car and railroad lines.
2. Sleeping and eating accommodations on or near airdrome.
3. Airdrome equipment; number of hangars, shop space, electric light, water, high test gasoline, oil, etc.
4. Shipping instructions to station nearest airdrome.
 - (a) Instructions for carload lots to spur nearest airdrome.
 - (b) Instructions for less than carload lots to station nearest airdrome.
5. The name of some reputable trucking and storage company.

MAP

Map showing the course, printed in the Rules and Entry Blank is desirable and will also eliminate considerable correspondence.

**(SUGGESTED FORM FOR NOTIFICATION OF ACCEPTANCE
OF ENTRIES COMPLYING WITH F. A. I. RULES)**

Dear Sir:

We hereby acknowledge receipt of your entry in the.....Race and hereby notify you that your entry has been accepted by the Contest Committee of.....for this event.

However, should the number of entries required by the rules for this event not be received by.....
(Date of closing of Entry)

and the events therefore cancelled, due notification will be sent you at the address given on your entry form.

A copy of the A. C. A. Rule Book and Rules for this event are being mailed you with this letter in accordance with F. A. I. Rules.

Yours very truly,

Chairman.....

Contest Committee of.....

CHAPTER IV

CONTEST OFFICIALS' DUTIES AND INSTRUCTIONS

The following officials have charge of the conducting of any Aeronautic contest:

Referees	Scorers
Judges	Police
Timers	Medical
Starters	Publicity

Representatives of the Aero Club of America.

The following Committees should also be present in case it is necessary for them to act as a Committee:

Contest Committee	Entertainment Committee
Technical Committee	Financial Committee

All members of the Contest and Technical Committee should serve as some official during a contest.

Duties of Officials

1. **REFEREE:** The Referee is in absolute charge of every contest and shall decide all matters with the advice of and assistance of the Contest Committee and Technical Committee Judges, Timers, Starters, etc. He may also inflict penalties (F. A. I. Rules, Art. 51-47). A Referee and Alternate Referee should be appointed. Referee wears a purple arm band.

2. **JUDGES:** The functions of the Judges are to see that the rules of the contest are properly carried out. Three Judges should be stationed at each of the following points:

Starting Line
Finishing Line
Each Turning Point

and any other control point which may be included in the conditions of contest. The Judges should be given instructions in writing as to their duties at the position to which they are assigned. Judges must have field glasses. Judges wear blue arm bands.

Official Aero Club of America

JUDGES' COURSE REPORT

Event

Place

Date

Airplanes Passed_____Pylon in the Following Order:

FIRST LAP		SECOND LAP		THIRD LAP		FOURTH LAP	
Position	Plane No.	Position	Plane No.	Position	Plane No.	Position	Plane No.
1st		1st		1st		1st	
2nd		2nd		2nd		2nd	
3rd		3rd		3rd		3rd	
4th		4th		4th		4th	
5th		5th		5th		5th	
6th		6th		6th		6th	
7th		7th		7th		7th	
8th		8th		8th		8th	
9th		9th		9th		9th	
10th		10th		10th		10th	
11th		11th		11th		11th	
12th		12th		12th		12th	
13th		13th		13th		13th	
14th		14th		14th		14th	
15th		15th		15th		15th	
16th		16th		16th		16th	
17th		17th		17th		17th	
18th		18th		18th		18th	
19th		19th		19th		19th	
20th		20th		20th		20th	
21st		21st		21st		21st	
22nd		22nd		22nd		22nd	
23rd		23rd		23rd		23rd	
24th		24th		24th		24th	
25th		25th		25th		25th	
26th		26th		26th		26th	
27th		27th		27th		27th	
28th		28th		28th		28th	
29th		29th		29th		29th	
30th		30th		30th		30th	
31st		31st		31st		31st	
32nd		32nd		32nd		32nd	
33rd		33rd		33rd		33rd	
34th		34th		34th		34th	
35th		35th		35th		35th	
36th		36th		36th		36th	
37th		37th		37th		37th	
38th		38th		38th		38th	
39th		39th		39th		39th	
40th		40th		40th		40th	

Recorded By.....

Checked By.....

.....

.....

Record Each Passage of Airplanes in the proper lap column.

Record Passing of Every Airplane. If Number Cannot Be Distinguished Put
own Name of Airplane. If Uncertain of That Put Down Question Mark.If Pylon is Fouled (See Rules on Back) (F. A. I., Art. 114, 115, 140) Mark
X and Write Report on Back.

RULES FOR ROUNDING PYLON

(F. A. I. Rules 114, 140, 115.)

"Contestants in making a turn must pass completely outside the pylons taking them always on the same hand which will be indicated by the rules."

"In order that aircraft may be credited with having rounded a pylon, it must have completely traversed the line bisecting the angle of this pylon and its vertex."

"In the case of open or closed circuits with re-entrant angles, contestants will be required to turn the pylon on the side of the vertex of the angle."

Fouling Mark

"Any competitor who has failed to turn a pylon properly may validly continue on the circuit provided he makes a complete turn of the said pylon and then continues his course in the proper direction."

Remarks

Signed {
 {
 {

(NOTE: The above is to be printed on back of Judges' Course Report.)

3. **TIMERS:** The functions of the Timers is to take all times of each airplane and properly record them upon the Timing Sheets.

NOTE: Where the electric timing apparatus is used there will be a Chief Timer and four Assistant Timers on the Timing Stand. (See diagram, page No. 71.)

An Assistant Starter shall be stationed in the Timers Stand who will communicate with the Chief Starter by flags as follows:

- (a) He will raise the red starting flag at the time scheduled in the program.
- (b) He shall acknowledge request for deferred starts by raising a blue flag.

The Chief Timer should have a pair of field glasses.

As only officially appointed Timers may officiate at sanctioned meets, it is unnecessary to give Timers instructions here. (For Timers' examinations, see F. A. I. Rules, Art. 53-54-55 addenda.)

Official Timer's Sheet (For Races)

The Official Timer's Sheet has been prepared to eliminate all possible errors by having:

1. Complete record of all times recorded by the timer.
2. Double check of addition and subtraction of recorded times.
3. Space for the position (first, second, third, etc.) of all planes after each lap and at end of race.
4. A large space for the number of each airplane on either side of the sheet.

NOTE: The Timer's Sheet should be printed on light weight cardboard, not paper.

METHOD OF RECORDING OFFICIAL TIMES

Preparatory:

Put down the number assigned each airplane on either side of the sheet in numerical sequence (one, two, three, etc., or 31, 32, 33, etc.). Also the name of plane and its pilot.

First Lap:

1. When the starting time of each airplane is announced by the Timer it should be recorded in the proper space in each lap.
2. When the time for completion of the first lap is announced by the Timer, it should be recorded in the space so marked just above the starting time.
3. Subtracting the starting time from the lap time gives net elapsed time for lap.
4. When all planes have completed any lap, the position of each plane (first, second, third or fourth, etc.) can be readily determined from the time for the lap or laps and the position of each plane should be marked in the space after the word "position," at the top of the column (this should be done as soon as possible and a report of the five leading planes in their respective positions sent to the score board).

Second Lap, Third Lap, Fourth Lap, Etc.:

1. Follow instructions given for lap one.
2. When the time for completion of two (or more laps) is announced by the Timer, it should be recorded in the space so marked *just above the starting time*.

3. Subtracting the starting time from the time of completing two (or more laps) gives net elapsed time for two (or more laps).
4. Follow instructions given for first lap.
5. Subtracting elapsed time for first lap from elapsed time for two laps gives net time for second lap, etc.

Race

1. Follow instructions given in paragraph one, for 1st lap.
2. Follow instructions given in paragraph two, for 2nd, 3rd, 4th, etc., laps.
3. Follow instructions given in paragraph three, for 2nd, 3rd, 4th, etc., laps.
4. Subtracting the elapsed time for all previous laps, from the elapsed time for the race, gives net time for the last lap.
5. Write down and add in the last column on the sheet all lap times. This total should correspond with the elapsed time for the race, which has already been obtained by subtracting the starting time from the finishing time and is a double check on both the subtraction and addition.
6. The elapsed time as checked in the above paragraph should then be written down in the space headed "O. K. and Corrected Time."
7. Follow instructions given in paragraph four to determine final position of contestants in race, and mark their position, first, second, third, etc., in the next to last column under "Placed."

PULITZER TROPHY **AERO CLUB OF AMERICA** **Mitchel Field L.I.** **November 25, 1920**
OFFICIAL TIMER'S SHEET

AIRPLANE NO.	PILOT <i>C.C. Mosley</i>	POSITION FIRST LAP	POSITION SECOND LAP	POSITION THIRD LAP	POSITION RACE	O.K.'D AND CORRECTED TIME	AND LAP TIMES IN THIS COLUMN	AIRPLANE NO.
63	PLANE <i>Verville-Bibb</i>							
	TIME OF COMPLETING	12-6.7	23-7.07	34-14.25	45-29.57	44-29.57	11-6.7	
	STARTING TIME	1-0.00	1-0.00	1-00.00	1-00.00	PLACED	11-37	
	ELAPSED TIME FOR	11-6.7	22-7.07	33-14.25	44-29.57	1 St.	11-7.18	
SUBTRACT TIME FOR PREVIOUS LAPS TO OBTAIN LAP TIME			11-0.37	11-7.18	11-15.32		44-29.57	

To simplify the timing of any race, the Timer's clock or watches should be set at zero hour for the start of the race. The starting times of the airplanes will therefore read in minutes and seconds only as is shown in the above example.

Starters

The duties of the Starter and Assistant Starters include getting the airplanes on the field in their allotted positions at the hour specified prior to the start, in addition to actually starting the events.

It is furthermore the duty of the Chief Starter to assure himself that his assistants understand the starting rules and signals, and to conduct actual rehearsals of the signals.

The Chief Starter and Assistant Starters shall have one red, one white, and one blue flag. The Starters wear yellow arm bands.

Instructions for Starters

The Starter and Assistant Starters shall set their watches with the Official Timers' time.

Flying Starts

In flying starts the contestants may take off from any part of the airdrome they desire, as their time is only taken when they fly across the starting line.

The Starter will start all contestants (a) in their allotted order and (b) at the proper time intervals (to be determined).

Method of Start (Flying)

The Starter will assign an Assistant Starter to the timing stand, and to each plane. The Assistant Starters assigned to planes will raise the signal flags to and for their respective pilots as follows:

The starting signal (for motors only), a red flag, will be raised by the Chief Starter upon signal from timers' stand at (example) 10:55 a. m. When the motor of each plane is running, or ready to be started, the Assistant Starter assigned to that plane will raise the red starting flag. When all Assistant Starters have raised the red starting flags, but not later than 11:00 a. m., the Starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal for the first plane to start will be given in ten seconds. Only the Assistant Starter assigned to the plane whose turn it is to start, shall raise the white warning flag, and with the Chief Starter count each second by lowering the red flag, the getaway signal being the lowering of both the red and white flags. If any contestant has difficulty in starting his motor, his Assistant Starter will not raise the red flag, but will raise a blue flag when the Chief Starter raises the white flag, if not before. The blue flag is a request for a deferred start, and shall be answered by the Chief Starter and the Assistant Starter in the Timers' Stand.

Deferred starts are granted without penalties, provided they can be made within a certain time limitation (to be determined). This

same method shall be used in starting each plane with the exception that raising a red flag after the first plane has been sent away indicates that the second and succeeding planes will be expected to start within the number of minutes decided upon as the starting intervals between contestants.

Any plane having once started cannot receive another start; however, it may complete the race, although forced down, provided it can do so before — p. m.

Standing Starts

Position at Starting Line:

Plan of lining up airplanes when several airplanes or groups or classes are to be started in the same race.

A stake for each airplane bearing its number should be driven into the ground and the planes will take their position at their stakes according to the accompanying sketch.

The first group or class to be sent away will be numbered from 1 to 9 and placed in front of the other planes assigned each Starter's Station (A, B, C, D, etc.) on the starting line.

The second group or class to be started should bear the numbers from 11 to 19.

The third group numbered from 21 to 29.

The fourth group numbered from 31 to 39, etc.

Placing the stakes and placing the airplanes at their stakes according to the sketch permits:

(a) The first plane at any Starter's Station to take off without the propeller blast interfering with any other airplane.

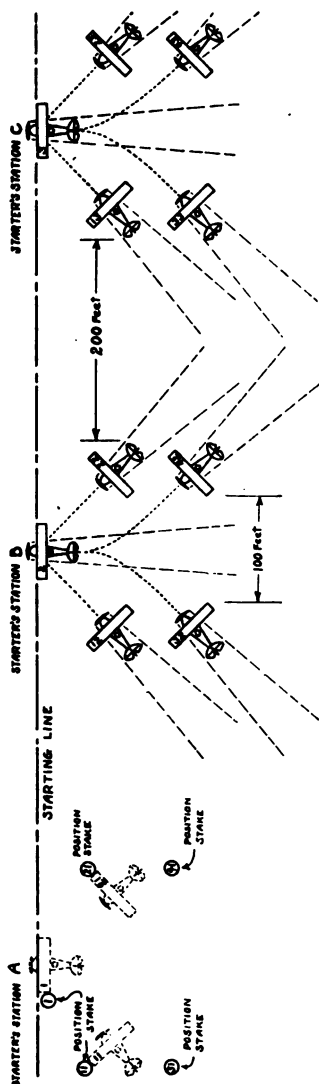
(b) Any or all planes at any Starter's Station to warm up or try out their motors without the propeller blast interfering with any other airplane.

When the first group or class of airplanes have been sent away, one from each of the Starter's Stations, A, B, C, D, etc., the second planes to start from each station should taxi up to the starting line. When they have been sent away the third plane to start should taxi up to the starting line, etc. An Assistant Starter with starting flags is stationed at each of the Starter's Stations and gives the starting signals for all planes in their proper order, assigned to this station.

Important:

Where one or more airplanes are started together the start must be made into the wind, therefore, it is necessary to locate on the field before the race, several starting lines with Starter's Stations in keeping with the expected or prevailing wind directions, but the stakes should not be driven in until the day of the race, at which time the direction of the wind will be practically assured and the correct starting line can be selected and staked.

POSITION AT STARTING LINE PREPARATORY TO STARTING SEVERAL GROUPS OR CLASSES OF AIRPLANES:



Sketch No. 1

(A) shows the proper location of stakes at any one of the Starter's stations along the starting line.

(B and C) show the airplanes correctly placed at their stakes at any Starter's station along the starting line.

The propeller blasts are outlined and the path of each plane from the stake to the starting line.

Note: Remember that airplanes numbered 1 to 9 are sent away at the same time, one from each Starter's station along the starting line. Then the second group numbered 11 to 19 taxi from their stakes to the Starter's line and are sent away together, one from each Starter's station along the starting line. Then airplanes numbered from 21 to 29 taxi from their stakes up to the starting line and are sent away at the same time, etc.

1. **WHEN THE DIRECTION OF THE WIND IS DIRECTLY OPPOSED TO THE DIRECTION OF THE FIRST LEG OF THE COURSE:** Under these (ideal) conditions, the starting line is at right angles, 90° to the direction of the wind and the airplanes take off into the wind and on the line of the first leg of the course. (See sketch No. 1 on page 58.)

2. **WHEN THE DIRECTION OF THE WIND IS ACROSS THE DIRECTION OF THE FIRST LEG OF THE COURSE:** The starting line should be placed on an angle from 60° to 45° into the wind, and a similar line approximately parallel to the starting line marked across the end of the field or not less than ½ mile distant. Observers should be stationed along this line.

Airplanes taking off will be required to hold a straight course into the wind until they have passed over the second line, at which time all planes will be in the air but so distributed that they may all turn at the same time without interfering and all will be approximately equally distant from the first pylon. The sketch on page 60 (No. 2) explains the principles:

3. **WHEN THE DIRECTION OF THE WIND CORRESPONDS TO THE DIRECTION OF THE FIRST LEG OF THE COURSE,** and the wind is of sufficient velocity to prevent taking off down wind, the standing start will have to be abandoned and the planes sent away separately for a flying start.

The Starter will start all contestants in the race, or any group or class, at the same time, sending the groups and classes (if more than one) away in their proper order, and at the proper time intervals (to be determined).

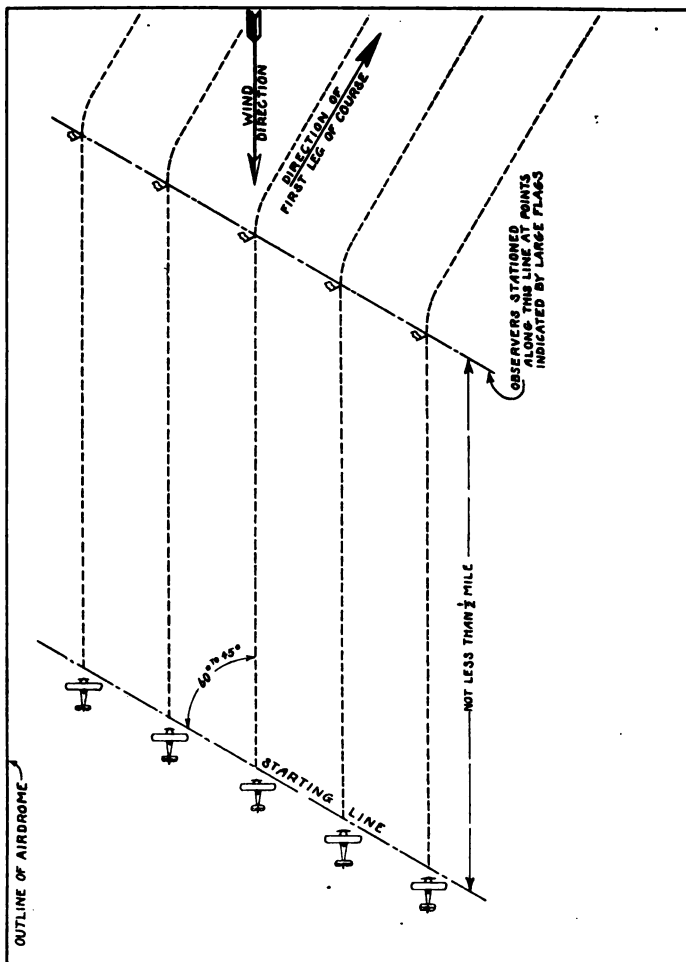
Method of Start (standing)

The Starter will assign an Assistant Starter to the timing stand and one to each starting position along the starting line.

NOTE: If there is more than one airplane assigned to any starting position along the starting line, one or more assisting Assistant Starters shall be assigned to such stations. their duties being to see that the airplanes assigned to their station are in their correct positions at the required time prior to the start and when the race is started that the contestants taxi to the starting line in the proper order.

The Assistant Starters shall raise the signal flags to and for the contestants about to start from their stations as follows: The starting signal (for motors only), a red flag, will be raised by the Chief Starter at 1:45 p. m. When the motor of each plane is running the Assistant Starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 2:00 p. m., the Starter will raise, in addition to the red starting flags, the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the blocks from under the wheels. Assistant Starters having raised white flags will follow Chief Starter

POSITION OF STARTING LINE WHEN WIND IS ACROSS FIRST LEG OF COURSE



Sketch No. 2

in counting each second by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his Assistant Starter will not raise the red flag, but, when the Chief Starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of — hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before — p. m.

When one or more classes or groups of airplanes are to be started in the same event, the above method of start shall be repeated for each class or group to be started. The interval of time between the start of the various groups shall be determined in advance.

Standing Starts (Seaplanes)

Contestants will be lined up along the shore in shallow water for the start. The Starter will assign an Assistant Starter to each plane who shall raise the signal flags for its pilot as follows: The starting signal (for motors only), a red flag, will be raised by the Chief Starter at 2:45 p. m. When the motor of each plane is running, the Assistant Starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 3:00 p. m., the Starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds; Assistant Starters having raised white flags will follow Chief Starter in counting each second by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his Assistant Starter will not raise the red starting flag, but, when the Chief Starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be started after a delay of — hours. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before — p. m.

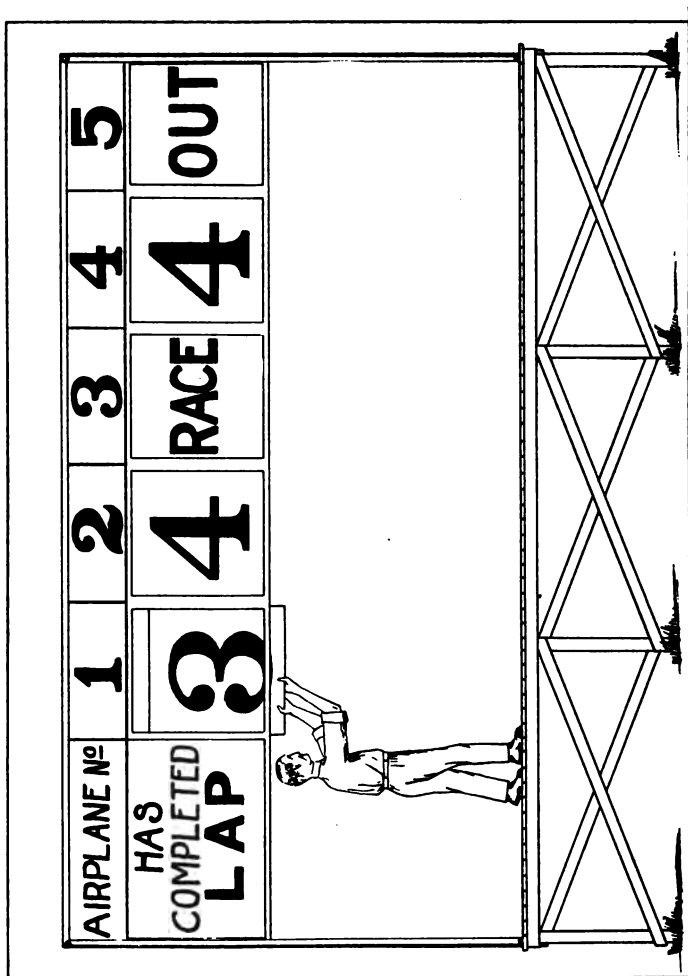
THE FINISH: The Chief Starter shall never attempt to signal the finish of any contestant when he crosses the finishing line. This information is far better given the spectators by the lap score board described on page 62, and eliminates the danger of confusion.

Scorers

The duties of the Scorers are:

- (a) to record the passage of each airplane at all turning points.

LAP SCORE BOARD



Sketch No. 3

Three Scorers should be stationed at all turning or control points with the Judges, and fill in the Judges' reports for each control.

(b) to operate (1) the lap score board, the number of Scorers depending upon the number of entrants; and (2) the position score boards, the number of Scorers depending upon the number of score boards. They must also obtain the necessary information from the Timers to fill in the positions of contestants on the score boards. (See place score board on page 64.)

Representative of the Aero Club of America

The duties of the representative of the Aero Club of America, who may serve in any official capacity that does not take him away from the airdrome, are to see that all requirements of the F. A. I. Rules and Regulations are carried out during the meet or event.

CONTEST COMMITTEE: The duties of the Contest Committee are to formulate the rules, prepare the programs, pass upon the validity of entrants and contestants, etc., prior to the race and to prepare a complete record of each event held during the meet (F. A. I. Rules 111, 145, 148). While each event is being contested, the management rests entirely in the hands of the officials.

TECHNICAL COMMITTEE: The Technical Committee's duties are to prepare any data that may be needed in the conditions of the contest and to see that the aircraft entered in each event complies with the technical requirements or limitations in each event, and to fill out the Technical Report of accessory equipment of each aircraft or any other Technical Report that may be required. (See Technical Committee Report Sheet.)

MEDICAL: The duties of the Medical Committee are to provide all medical assistance that might be required.

POLICE: The most important duties of the Police are to patrol the boundaries of the airdrome and permit no one within its enclosures unless they are wearing an official arm band.

The following are the officials and individuals and their official bands, who are allowed in any part of the airdrome.

Referees, purple.	Timers, green.	Mechanics, brown.
Judges, blue.	Scorers, green.	Medical, red cross.
Starters, yellow.	Contestants, brown.	

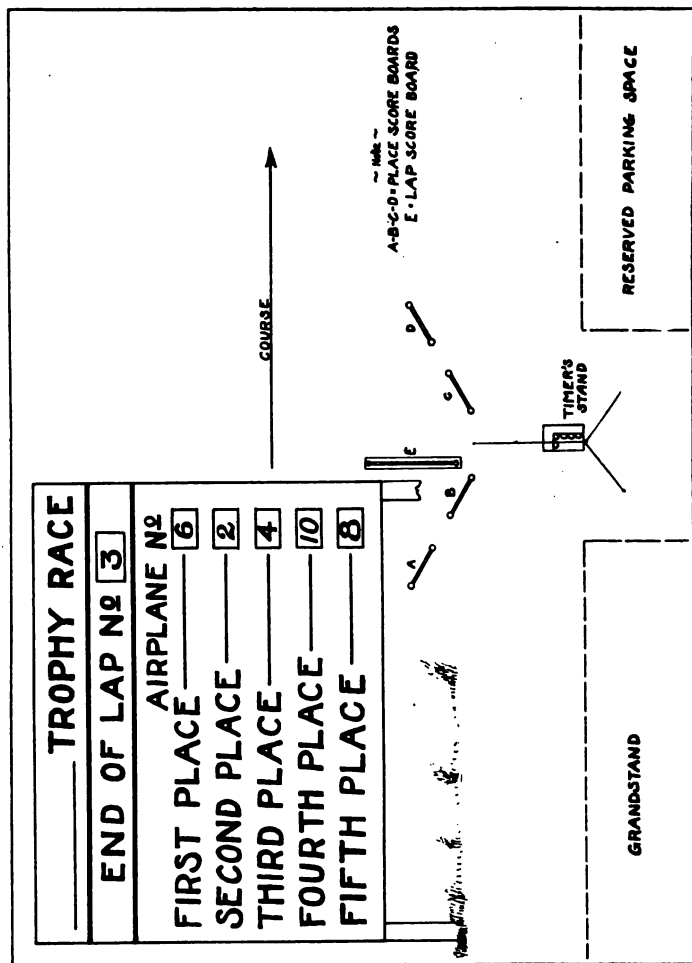
Members of the Contest Committee, red.

Members of the Technical Committee, gray.

Guest and Press, white.

Communication and Police, white.

PLACE SCORE BOARD



However, as soon as all contestants in any event have been started, the center of the airdrome used for landing purposes should be cleared and kept clear.

Fire apparatus is also under police control. The most efficient fire fighting apparatus consists of motorcycle side cars, each carrying two men and several pyrene or similar extinguishers, axes, wood and hack saws, and wire cutters or pliers capable of cutting heavy airplane cable.

Side cars serve as the best means of communication and transportation on the airdrome. This is also under police control.

Flags, Arm Bands, Etc.

Arm bands should be made of wide satin ribbon or felt with the name of the official and the date or dates of the meet printed upon it; preferably in gold. The following are the names, colors and approximate number required:

Title	Color	Number
Referee	Purple	2
Judges	Blue	20
Starter	Yellow	2
Asst. Starter	Yellow	20
Timer	Green	5
Scorer	Green	40
Technical	Gray	12
Contest Committee	Red	20
Contestant	Brown	40
Mechanic	Brown	200
Communication	Black	12
Guest	White	200
Police	Black	50-100
Press	White	50
Medical	Red Cross	10

Flags marked "Official Car" should be provided for officials to avoid traffic delays.

Red, White and Blue flags about 18 by 24 mounted on poles approximately 3 feet long, must be supplied each Starter and Assistant Starter.

Telephones

Telephone communication between the Timer's Stand and pylons is absolutely essential. There should also be an outside telephone in the Timer's Stand connecting with other parts of the field and the city. Also a direct telephone from the Timer's Stand to the score boards, if these are located at points distant.

As the majority of Accessory Manufacturers are keenly interested in the results of important aeronautic events, the Technical Committee should make a complete accessory report of each airplane entered in important events prior to the event, in order that the Contest Committee may include this information in their final report of the event.

ACCESSORY REPORT OF TECHNICAL COMMITTEE.

Airplane No.

Pilot

Airplane

Airplane Design

Made by

Motor

Motor Design

Made by

Accessories

Propeller D.	P.	Made by
Radiator, type		Made by
Starter, type (if installed)		Made by
Carburetor, type		Made by
Spark plugs, type		Made by
Ignition (magneto) (Delco)		Made by
Battery, type		Made by
Tires, size		Made by
Tachometer, type		Made by
Compass, type		Made by
Air Speed Indicator, type		Made by
Aneroid		Made by
Thermometer, type		Made by
Fuel, grade		Made by
Oil, grade		Made by
Paint or Varnish		Made by

CHAPTER V

THE AIRDROME

Timer's Stand, Score Boards, Grand Stand and Parking Space.

Grand Stand and Parking Space

In determining the location of the Grand Stand and Reserve Parking Space for motor cars, careful consideration must be given to the direction of the course across the airdrome, and the location of the turning pylon, if there is to be one on the field. The Grand Stand and Reserved Parking Space shall never be placed on the airdrome across the direction of the line of flight of the course, as the contestants will fly quite low across the starting and finishing line and will also round the turning pylon at low altitudes, and should they experience motor trouble will be obliged to practically land in the direction in which they are going.

The Grand Stands and Reserved Parking Space should be placed on the edge of the airdrome parallel to the line of flight of the incoming planes before they have reached the turning pylon. This is the safest and most spectacular position. (See Sketch No. 1, page 69.)

Timer's Stand and Score Boards

THE IDEAL LOCATION OF THE TIMER'S STAND (See Sketch No. 1, page 69) is on the edge of the airdrome, between the Grand Stand and Reserved Parking Space. The starting line (for flying starts) and the finishing line should be located directly in front of the Timer's Stand and the turning pylon (if one is to be located on the airdrome) beyond the finishing line.

The score boards should be placed in front, but a little to one side of the Timer's Stand in plain view, both the Grand Stand and Reserved Parking Space.

ANOTHER LOCATION OF THE TIMER'S STAND (See Sketch No. 2, page 70) is on the airdrome, in which event it may serve as the turning pylon as well as the starting line for flying starts and finishing line.

This arrangement is a little more spectacular, but cannot be used when there are so many entries that all cannot be started before any plane can complete the first lap.

NOTE: As the length of a closed circuit is measured by the distances separating the pylons (F. A. I. Rules, Art. 143) the starting and finishing lines being perpendicular to the direction of the course are the same distance from their respective pylons as the home turning pylon.

CONSTRUCTION OF THE TIMER'S STAND (Sketches Nos. 3 and 4, pages 71 and 72). These sketches show the construction best adapted for electric timing. (Electric timing should be used for

all important races.) The Timer is seated directly under a pair of sighting wires which establish a plane through the sky above the starting or finishing line, which must be located upon the field directly in front of (in the plane of) the sighting wires.

The starting or finishing lines should be about 100 yards long and clearly marked in white upon the field. The ends of this line should be clearly marked as planes are required to cross the starting or finishing line within the marks defining this line. Requiring all contestants to cross the starting or finishing line in this manner compels them to fly through the plane established through the sky by the Timer's sighting wires.

The electric timing apparatus prints the time on a paper ribbon similar to a stock ticker tape and the number of each airplane is written opposite the time recorded for it. The ribbon is passed along the table in front of the recording Timers and serves as a check for the times as announced by the Timer.

Courses

Closed courses up to 50 miles in length should have a symmetrical form as the topography over which the course is laid must be reasonably flat and offer considerable number of possible landing places.

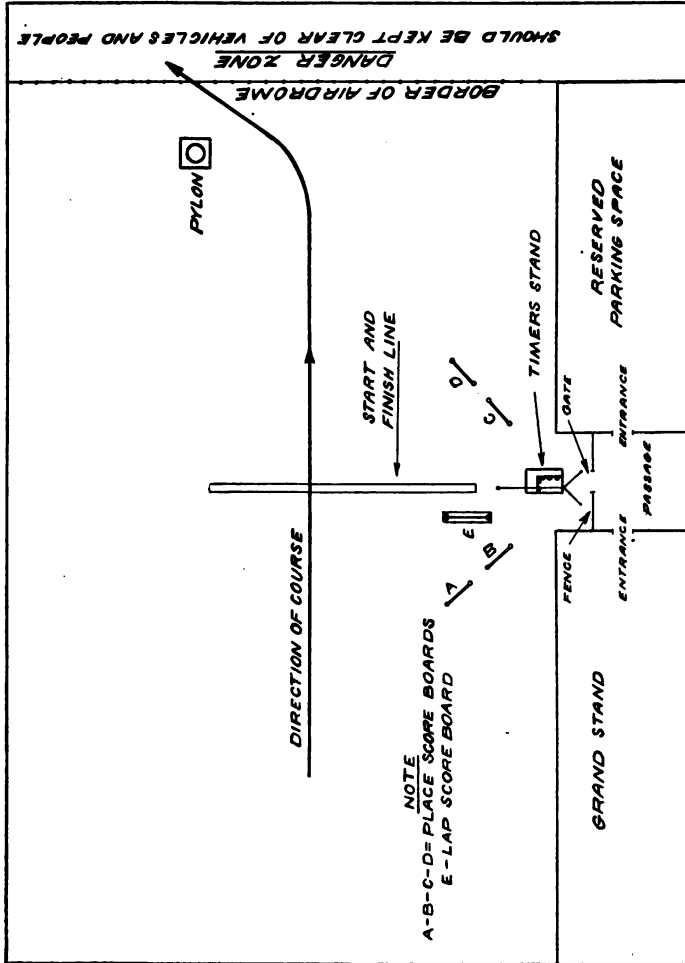
The triangular course is the simplest, requiring only three turning pylons, also three control stations.

The rectangular course required four turning pylons, also four control stations.

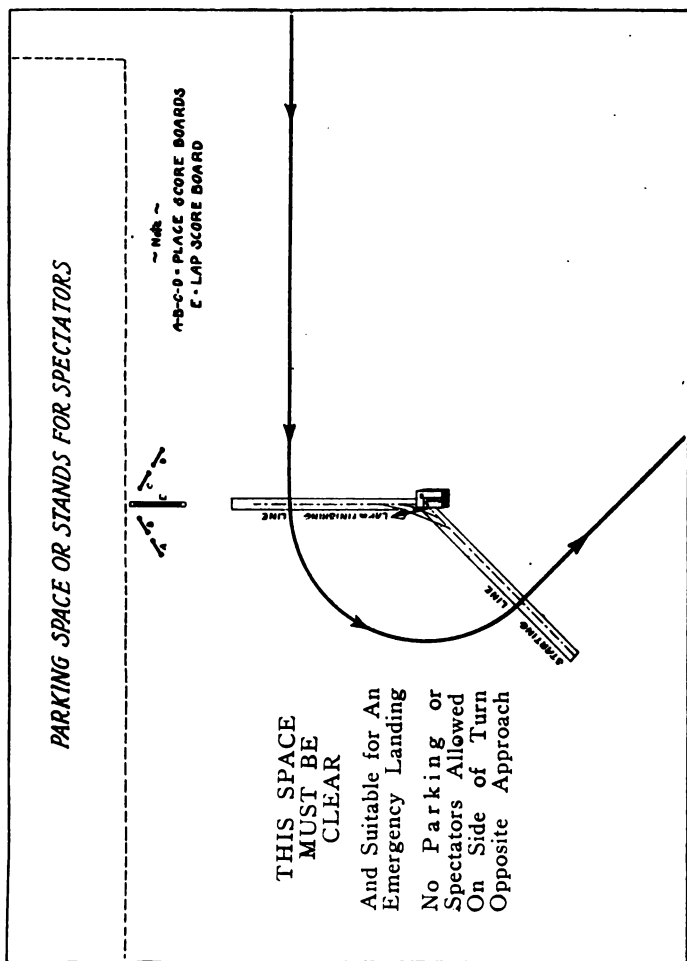
The pentagonal course requires five turning pylons, also five control stations, etc., etc.

No race will be sanctioned from one point to another and return unless the course is in the shape of an oval with the parallel sides at least five miles apart.

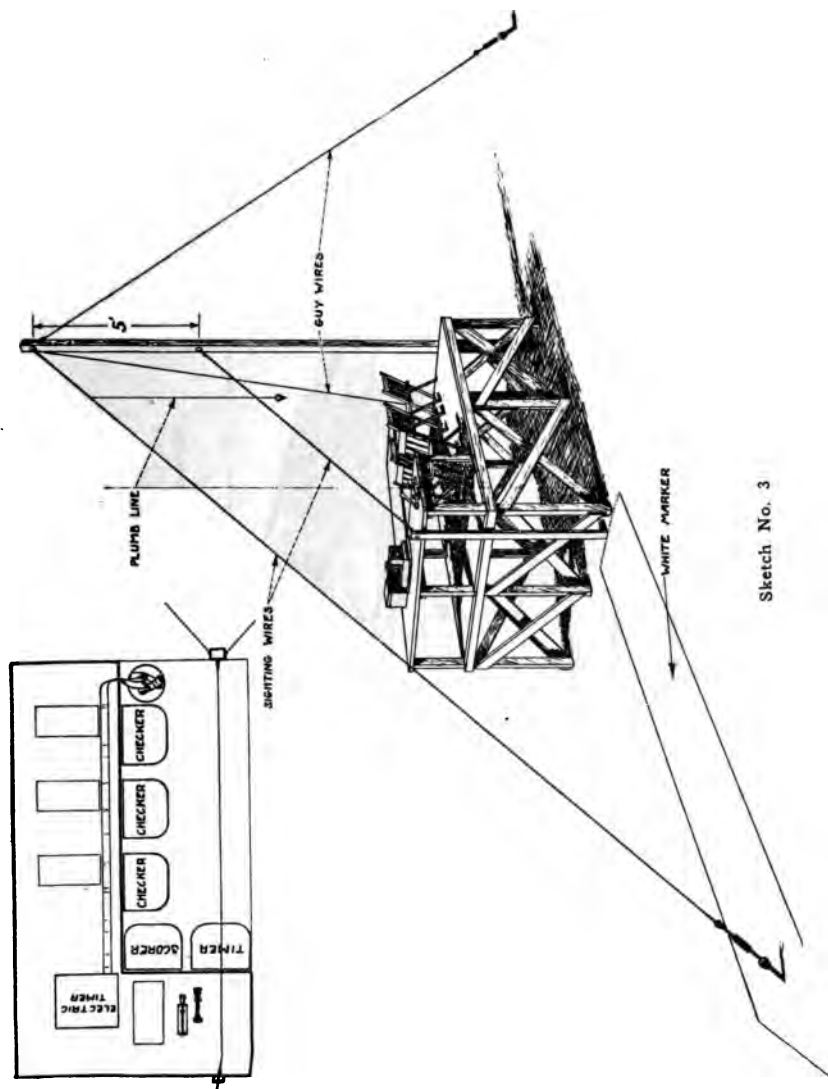
An oval course of sufficient size to have very gradual turns is the fastest, but has this disadvantage; at least five pylons must be placed at either end giving a total of ten turning pylons, also ten control stations. (See Sketch No. 5, page 73.)



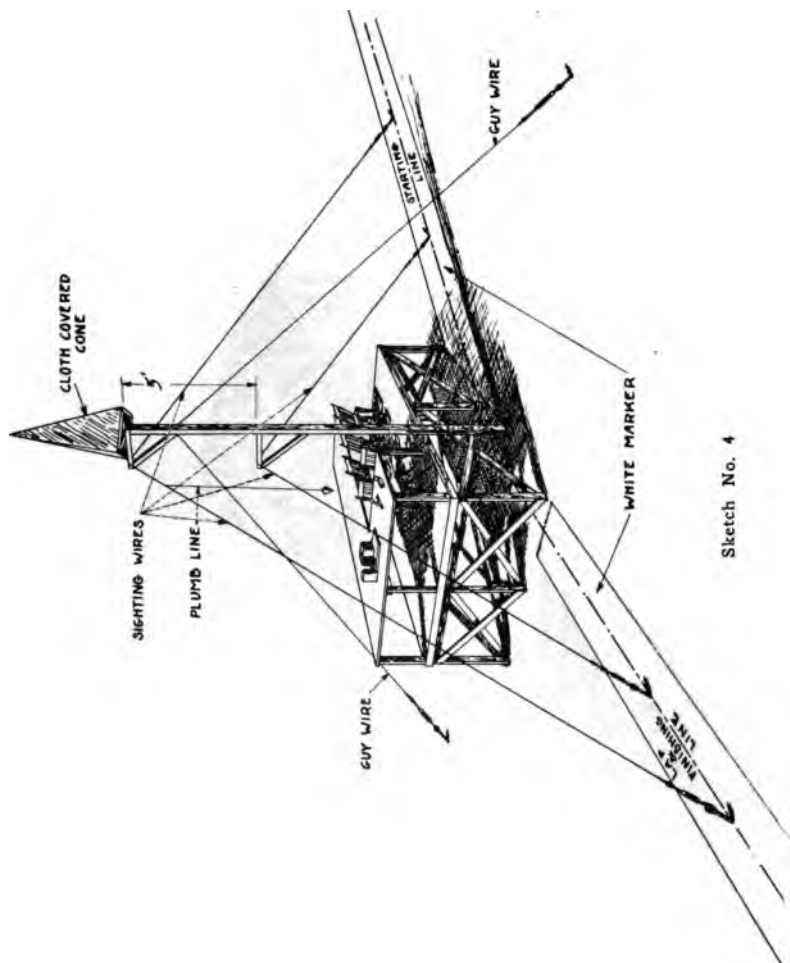
Sketch No. 1



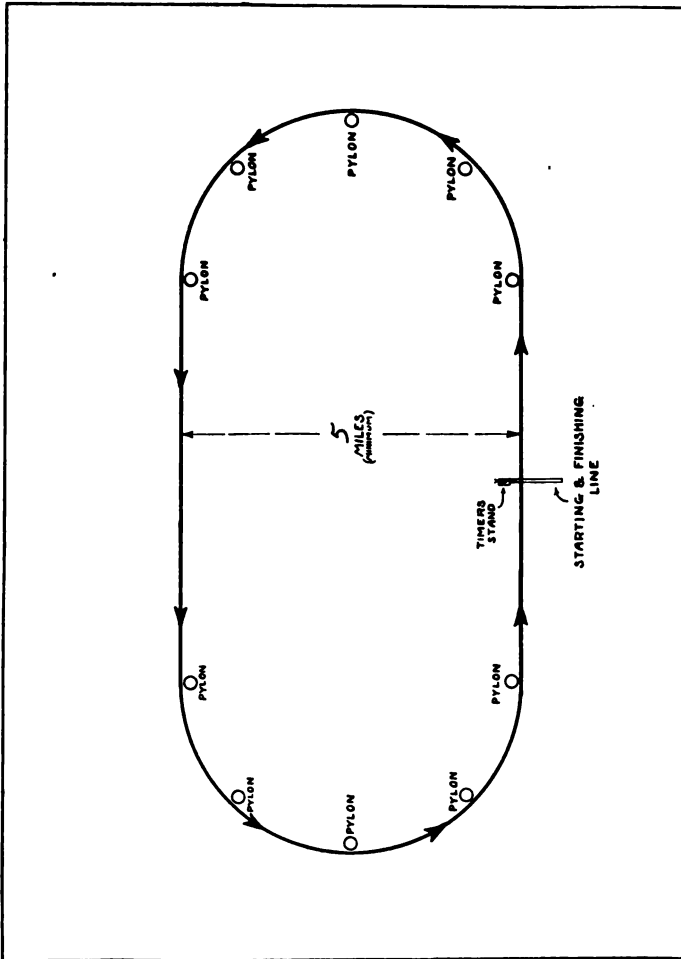
Sketch No. 2



Sketch No. 3



Sketch No. 4



Sketch No. 5

SECTION TWO

Free Balloon Races

CHAPTER I

FREE BALLOON RACES

General Character

A balloon race, from an organization standpoint, has the great advantage of having very flexible requirements as to field and surroundings. The great size of the balloons and the uncertainties regarding their route, etc., also appeal very strongly to a sport loving public. But in spite of the seeming dangers of such a contest, long experience has proved it to be one of the safest sports known, both for contestants and spectators. It has long been the custom to hold these races from the very heart of such cities as Berlin, Paris and St. Louis with, as far as we know, never a single accident to any spectator. We also have on record only one case of a fatal accident to a contesting balloon.

The most famous races are those for the International Gordon-Bennett Cup, which was first contested for in 1906. This is the "America's Cup of the Air," having been won four times by this country, the most by any other country being twice. The race is held each year in the country which won the cup the preceding year, and if any one country wins it three times in succession (which has never yet been done) it remains the permanent possession of that country. In this country the American National Race has now become an annual fixture for determining the American championship and also for selecting the three pilots to represent America in the International Race. This race is usually held during the month of May, from some inland city.

Various Kinds of Balloon Races

A balloon contest may be for any one or more of the following objects:

- Distance
- Duration
- Altitude
- Speed
- Landing closest to a given point

"Fox Hunt" or landing closest to the landing place of a certain balloon, this being often combined with a similar contest for automobiles.

The National and International races are always for distance as it is found that this includes nearly all other qualities. The winner is he who can so plan his altitude, route, etc., as to use the existing weather conditions to the best advantage.

Choice of Field

- (a) The field should be of sufficient size to safely accommodate the number of balloons entered, and should be smooth and have no stubble or other growth of a nature that might damage the envelopes of the balloons.
- (b) The height of surrounding obstructions, i. e., trees, houses, telephone wires, etc., should not exceed 30% of the horizontal distance between them and the "starting position."
- (c) The field should be located in as close proximity as possible to the gas holders and works, so that gas mains may be laid directly into the field assuring an ample supply at constant pressure in a specified time, and cause no serious inconvenience to nearby residents by reducing their gas supply during the period of inflation.
- (d) The field must be accessible both as a means of getting the equipment to the field, and near car lines and good roads for the benefit of the public, from whom a charge may be collected for admission to the field.
- (e) A fence should surround the field in order that the crowd may be more easily kept in control. The grandstand should be roofless if in close proximity to the balloons.

Arrangement of Field (See Sketches Nos. 6 and 7, Pages 81 and 82).

There should be sufficient space that the balloons may be placed about one diameter apart, i. e., two diameters between the center lines of each station. This figures approximately 100 feet between the center lines of each station for 80,000 cubic foot racing balloons (such as are used in national and international races). There should also be at least 100 feet between the center of these stations and the outside boundaries of the field.

Every balloon station is numbered and a corresponding number (which is drawn by lot) assigned to each contestant. The balloons "take-off" in consecutive order and the station numbers should be so arranged that the balloons nearest the starting position leave first.

The final location of the starting position is dependent on local conditions, viz: location of existing grandstands, direction of the wind across the field, etc. Therefore, in certain cases it may be necessary to change the starting position shortly before the race.

Gas Supply

A guaranteed supply of gas should be arranged for in advance. The volume required will be the total volume of all balloons entered plus 10%. This volume should be delivered in from four to six hours. Inflation in less than four hours entails excessive work for the ground crew.

The specific gravity of the gas should be as low as possible. It will usually be found possible to arrange for a better quality of gas for a balloon race than is regularly supplied to the city consumers. Good coal gas should have a lift of 42 to 48 per 1,000 cu. ft.

Balloon races are generally held in the afternoon from 4 p. m. to 6 p. m. Inflation should be so timed as to be completed a good two hours before the start.

If the gas company for any reason cannot supply all of the gas during the day it will be possible, but by no means desirable, to partially inflate during the night. This method requires that the balloons be "bedded down" during the following morning, a difficult proceeding, in case of storms or high winds. It also requires that the contestants lose more or less sleep, since at least one of each crew must be on hand during inflation.

Pipe Lay-out

The gas pipe lay-out usually found most practical for balloon fields consists of a single large pipe or main laid down the center of the field. Smaller pipes lead off at each balloon station. These lead-off pipes should be not less than six inches in diameter. The size of the large main is dependent on the number of balloons to be filled, the average pressure of gas in the main lines and the length of time desired for inflation. This is a special problem to be settled by the local gas company officials. It is possible to step down the size of the main pipe after passing every three or four balloon stations.

All lead-off pipes should be run toward the center of each balloon station to a distance of 75 feet from the center of each station. No special fittings are required on the ends of the lead-off pipes. Each contestant will have with him a fabric pipe which he will tie over the end of the lead-off pipe to carry the gas from that point to the appendix of the balloon.

One master valve should control the gas supply at the point where the gas main enters the field. A pressure gauge and recording meter should also be installed at this point. An auxiliary valve should be inserted in each lead-off pipe in order that the gas supply to individual balloons may be controlled. During the period of inflation a properly authorized person should be stationed at the master valve and at each double lead-off.

Fire Hazard

Contrary to the popular opinion no danger is attendant while balloons are being inflated provided ordinary precautions are taken. Illuminating gas can not explode unless thoroughly mixed with at least 15% of air. To protect the balloons themselves no smoking is allowed on the field. Signs on which are printed in conspicuous type "NO SMOKING" should be placed at frequent intervals throughout the field, and a squad of men should be detailed to see that the rule is enforced.

Ballast

There should be dumped at a point 100 feet from the center of each balloon station a pile of clean, dry sand. This should be well screened, free from lumps, stone and clay. Approximately 5,000 pounds of sand (2.5 cu. yds.) is required for each 80,000 cubic foot balloon. In case balloons of other capacities are used the amount of sand dumped at each station may be determined by use of the following formula: (volume of balloon \times lift of gas + 40%). As it is usually more convenient to haul the sand several days before the race, provision should be made to keep the sand dry in event of rain. Small tarpaulins may be used for this purpose. Sufficient helpers should be provided with necessary shovels to assist the balloonists in filling the sand bags the day before the race. Local boy scouts may be requested and used for this work.

Supplies

The committee in charge of supplies should see that plenty of cold drinking water is available on the field and a stand for the sale or dispensing of hot coffee and sandwiches. Approximately 10 pounds of unslacked lime should be provided for each balloonist for convenience of those using this as a means of cooking. Each balloonist will also want special equipment or supplies which the same committee may help him purchase. This includes such supplies as food, maps, hardware, rope, canvas, hydrogen and oxygen tanks, clothing, water cans, camping equipment, ammunition, etc.

Each balloonist should be supplied with approximately two dozen large envelopes made of red paper and printed in large type "BALLOON MESSAGE," also the following note, "Finder please telegraph the enclosed message as soon as possible, noting therein the name of the town which the balloon is passing over." The message blank should have space for the pilot to fill in his approximate altitude and direction of travel, time, and any other relevant information. The messages should be directed to the Contest Committee of the Aero Club of America or the club conducting the race. The envelopes may be weighted with a small piece of lead and carry a bright colored streamer.

Each contestant must be supplied with the necessary control documents. (See Aero Club of America, Rule Book F. A. I., Appendix 3-a, b, c,—4.)

No advertising matter is allowed on the balloons other than the name of the balloon, its manufacturer and banners of clubs, etc.

Helpers

To assist the pilot and his aide in laying out and handling the sandbags, etc., before and during inflation, a crew of from 8 to 12 men per balloon is required. This work while not hard requires a certain amount of perseverance and intelligence. The club members who are very enthusiastic and willing before the race seldom last out until the end and their interest in out of town friends, etc., cause them to forget their responsibilities, hence they should not be relied upon for manual labor. Local boy scouts and similar organizations are willing, but hardly equal to the tasks required. Paid civilians are good if of a high enough mental quality. The best type of men, however, are the military (army, navy or national guards). Volunteers can always be secured from some local garrison or field. Sleeping quarters and hot food for these men should be arranged for in advance. Authorization should be vested in one competent person, who may appoint as many assistants as he desires and who will be in full charge of the various balloon crews. A tent or office of some kind should be established on the field to which the crews may report and which may be used as headquarters by the Aero Club officials and pilots.

Metrology

Prior to the race, arrangements should be made with the United States Weather Bureau for special daily reports giving surrounding weather conditions and particularly "highs and lows" and wind speeds and directions prevalent at various altitudes throughout the country on the day of the race. Arrangements should be made to get the latest reports possible to each balloonist before he leaves. The Weather Bureau usually details a special representative from Washington for a National or International Race.

Procedure on Field

Balloons must be ready to start inflation at a specified time. Inflation of all balloons takes place simultaneously. When all are inflated, the main gas valve is shut off and none can receive more gas. Balloons are usually sent off at five minute intervals. Ten minutes before specified starting time, No. 1 balloon shall be ready and will be moved into the "runner up" position. The pilot will

make a preliminary weigh-off and get in final condition to go. Five minutes before start the balloon will be moved into the starting position. The Official Starter will take charge of the final weighing off, making sure that the balloon is light enough to clear all obstructions. Each full minute before the start he will notify the pilot of the time. Then at intervals of 10 seconds during the last minute and every second during the last 10 seconds, he will state the number of seconds left. On the last second the command to release is given and the balloon rises.

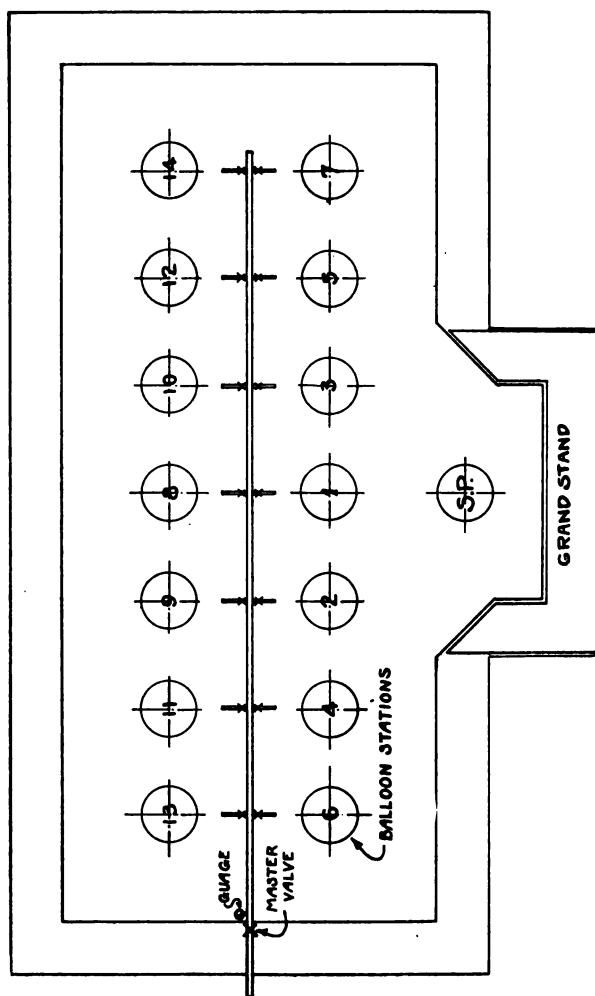
During these proceedings Balloon No. 2 has been walked into the "runner-up" position ready to move into the starting position. In the event of a heavy wind coming up before the start of the race and it being found impracticable to use the prepared starting position, the balloons may at the discretion of the starting official, be started from other positions irrespective of their original order.

Officials

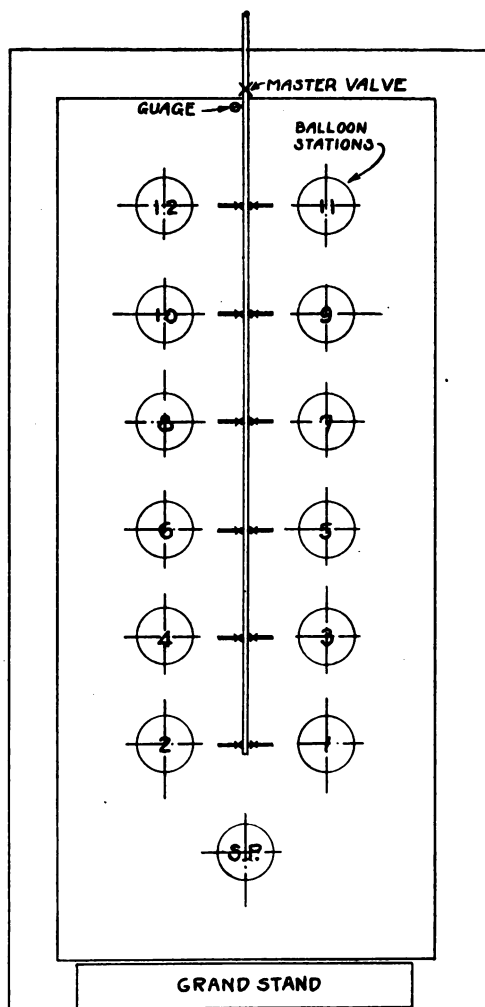
The duties of the Referee and Directing Officials are to see that the program of events is carried out; to be sure that each contestant is supplied with the necessary log of flight and landing certificates. (See F. A. I. Rules, Art. 40-122, Appendix 3-a, b, c,—4.) Copies of these control documents can be secured from the Contest Committee of the Aero Club of America or may be printed by the local club, providing they conform to the F. A. I. regulations contained in the Aero Club of America Rule Book. The Referee shall be responsible for measurement of the balloons. He shall also see that each balloon is equipped with the proper instruments or control devices and is in generally safe condition for flight. (See F. A. I. Rules, Art. 119, 120, 121.) A copy of the F. A. I. recommendations for safety of construction may be consulted at the Aero Club.

It is the duty of the Timers to see that the watch of each contestant agrees with his own and that his corresponds with the official time of the place of departure, F. A. I. Rules, Art. 126.

The time of departure shall be taken at the moment the Timer begins to see the bottom of the basket or nacelle, if at that moment there no longer exists any connection between the balloon and the ground. (See F. A. I. Rules, Art. 136.)



Sketch No. 6



Sketch No. 7

SECTION THREE

International Aeronautic Federation

Statutes and General Rules

(Translation of Third Edition published 1920

Revised to 1922.)

Fédération Aéronautic Internationale

Secretary's Office—35 Rue Francois-Ier.

Paris

Clubs and National Federations of the F. A. I.

ARGENTINE

Aero-Club Argentine
Telephone Florida 26, Buenos-Ayres

AUSTRIA

Osterreichischer (Aéro-Club)
Telephone 53.835. Vienne I

BELGIUM

Aéro-Club of Belgium
73, Avenue Louise, Brussels
Telephone 123.46—Telegraph: Aero-Club

BRAZIL

Aéro Club of Brazil
Avenida Rio-Branco, 183 I° andra
Rio de Janeiro

CHILI

Aéro Club
Huerfanos 1062
Santiago
Telephone National 5, Telegraph: Aéro-Club

CHINA

Fédération Aéronautique
Pekin

DENMARK

Danske Aeronaustiske Selskab
34, Ameliegade, Copenhagen
Telegraph: Aéro-Club, Copenhagen

EGYPT

Aéro-Club of Egypt
Cairo

SPAIN

Real Aero Club De Spain
(Commission Aeronautica)
Carrera de San Geronimo, 8 Madrid
Telephone: 4430.—Telegraph: Aero-Club Madrid

UNITED STATES OF AMERICA

Aero Club of America
New York
Cable address: Aeroclub, New York

FINLAND

Aeroklubben
Mariegatan 23A
Helsingfors
Telephone 63.17. Puh.

FRANCE

Aero Club of France
35, rue Francois-Ier, Paris
Telephone: Passy 66-21.—Telegraph: Aéro-Club
Paris

GREAT BRITAIN

Royal Aero-Club of the United Kingdom
3, Clifford Street, London W. I.
Telephone: régent 1327-8-9—Telegraph Aerodon-London

ITALY

Federazione Aeronautica Nazionale Italiana
Via Tor de' Specchi, 24, Rome

JAPAN

Teikoku Hiko Kyokwai
(The Imperial Aero Society of Japan)
Yurakucho, Kojimachi-Ku, Tokio

NORWAY

Nords Luftseiladsforening
(Aero Club of Norway)
Postboks 313. Poste centrale, Christiana
Telegraph: Luftseiladsforeningen

HOLLAND

Koninklijke Nederlandshe Vereeniging Voor
Luchtvaart (Aero-Club royal des Pays-Bas)
Heerengracht 13, The Hague
Telephone: 6139. Telegraph: Aero-Club, The Hague

POLAND

Aero Club
7, rue République, Poland

PORTUGAL

Aero-Club of Portugal
T. de Gloria A 2° D, Lisbon

SWEDEN

Kungl. Svenska Aeroklubben
(Aero-Club of Sweden)
Fenixpalatset, Stockholm, I.
Telegraph: Aero

SWITZERLAND

Aero Club of Switzerland
11, Schwarzthorstrasse, Berne
Telephone: 494

CZECH-SLOVAKIA

Aviaticky-Klub
4, place République, Prague

URUGUAY

Centro Nacional de Aviation
Plaza Independencia, 824, Montevideo

F. A. I. STATUTES

CHAPTER I

Article A-1	Principles of the F. A. I.
Article A-2	Personal Statutes.
Article A-3	Real Statutes.
Article A-4	Objects of the F. A. I.
Article A-5	Administration.
Article A-6	Seat of the F. A. I.
Article A-7 to A-12.....	Conferences.
Article A-13	Expulsions.
Article A-14	Votes.
Article A-15	Budget and Dues.
Article A-16	Membership.
Article A-17	Organizations affiliated with the National Federation.
Article A-18 to Art. A-20.....	Sanctions.
Article A-21 to Art. A-24.....	Licenses and Certificates.
Article A-25 to Art. A-27	Records.
Article A-28	Amendments to Statutes and Regu- lations.
Article A-29-Art. A-30	Dissolution-Liquidation.
Article A-31	Jurisdiction.

STATUTES OF THE INTERNATIONAL AERONAUTIC FEDERATION

Art. a-1. Under the title "International Aeronautic Federation," an International Union of the federations or clubs that control aeronautic sport in their respective countries has been established.

Aeronautics and aviation will be directly represented in this International Federation by the respective clubs and federations.

In each country and in all branches of aeronautics only one sporting authority is recognized, hereafter called National Federation.

Any country represented in the F. A. I. is understood to be the nation, and includes its Dependencies, Dominions, Protectorates, or Colonies.

At any time the F. A. I. may recognize a National Federation in any Dependency, Dominion, Protectorate, or Colony, but only with the formal consent of National Federation formerly in control. This decision can only be ratified by a vote at a conference of the F. A. I., taken under the conditions governing expulsions.

The National Federations, by the act of their admission into the F. A. I. subscribe without reservation to the statutes and regulations and their appendices.

The principles of the F. A. I. are as follows:

(a) Acceptance by the F. A. I. of the national regulations and personal statutes of each affiliated National Federation.

(b) Regulation of competitions by two classes of statutes: (1) Personal statutes; (2) real statutes.

(1) Personal Statutes

Art. a-2. The status and qualifications of every aeronaut or aviator of the federated nations will be determined by his national code, or by an international code, or in the absence of these, by F. A. I. regulations.

(2) Real Statutes

Art. a-3. The regulations controlling competitions and records in one of the countries of the F. A. I. are applicable in that country to any competitor, whatever may be his nationality.

Objects of the F. A. I.

Art. a-4. The F. A. I. is charged with the international regulation of aeronautics, for the purpose of making comparable the results of all trials, races, etc., also with actual supervision of aeronautical activities.

The F. A. I. will also decide, without appeal, issues that may arise between National federations.

Administration

Art. a-5. The F. A. I. is directed and administered by a Committee composed of a president, of seven vice presidents, of a secretary general, of a recording secretary, of a treasurer, and of one delegate for each country not represented by one of these officers; the secretary general and the treasurer must reside at the seat of the F. A. I.

The Committee will be elected annually at the conference.

Vacancies occurring in the course of the year will be filled by the Committee, subject to ratification at next conference.

The F. A. I. may name Special Committees for the investigation of particular questions.

Seat of the F. A. I.

Art. a-6. The seat of the F. A. I. is fixed in Paris.

Conferences

Art. a-7. A conference, composed of delegates from national federations will be held each year.

Art. a-8. The presence of the secretary general of the F. A. I. at all the conferences is obligatory.

Art. a-9. Upon the request of four national federations an extraordinary conference will be called by the Bureau of the F. A. I. within two months after the request properly accompanied by the order of business has been made, and in a town or city to be designated by the Bureau. The Bureau may add any further business which it wishes considered.

This procedure is not applicable in the case of an appeal to the F. A. I. In such case the Bureau will not convoke an extraordinary conference except upon suitable recommendation properly supported and transmitted to it by a college of three arbitrators belonging to none of the countries involved, and selected; the first two by the parties at issue, and the third by the President of the F. A. I., from a list composed of one representative of each National Federation. This list will be prepared each year by the ordinary conference.

The report of the arbitral college thus formed must include with its opinion upon the reasonableness of the appeal to an extraordinary conference its estimate of the merits of the case.

Art. a-10. All questions transmitted to the secretary's office at least two months before the date of the conference shall be placed upon the order of business of the ordinary conference.

The order of business shall be communicated by the Bureau, to the National Federations, at least a month before the meeting of the conference.

The modifications and remarks proposed and not entered upon the order of business are open to discussion, provided they shall be proposed by the delegates of two National federations.

Proposals in order to be considered in the order of business must be sufficiently detailed and accompanied by a brief summary, permitting preliminary summary of the question.

The vote of the majority of National Federations present at a conference validly decides any issues. In case of a tie, the voice of the President shall decide the tie.

A vote concerning questions not included in the order of business, is valid only if the majority of National Federations are present at the session.

The conference will designate the place and month in which the next regular conference will be held the following year.

Art. a-11. Requests for admission to the F. A. I. must be addressed to the Committee, which will submit them to the next conference. Temporary admission may be granted by the committee until ratified by the conference.

Art. a-12. Each delegate can represent but one National Federation. He must be a member of the Federation which he represents and a citizen of that country.

A National Federation may not send more than 6 delegates to a conference. However, the following are not counted as delegates:

- (1) The members of the Committee (F. A. I.).
- (2) Representatives of permanent or temporary commissions.

Expulsions

Art. a-13. The F. A. I. may expel a National Federation either temporarily or permanently. The proposition to expel must appear in the order of business. Expulsion can only be pronounced by two-thirds of the votes of the National Federations represented at the session, in the course of which the vote is taken.

If the expulsion includes all citizen members of the National Federation which have been expelled, the records must make mention of this fact, stipulating that the provisions of the second paragraph of Article 4 of the General Regulations are not applicable to such members.

If the expulsion does not extend to the citizen members, the F. A. I. may designate another Association to represent them in the place of their own National Federation.

Votes

Art. a-14. In each ballot taken at a conference of the F. A. I., each National Federation will cast its allotted number of votes—from 1 to 4.

Each National Federation newly admitted will be allotted one vote *in the first regular conference* in which it takes part, as well as in *special conferences* which may take place before this regular conference.

Each of the other National Federations will have 2, 3 or 4 votes according to the decision given in this respect at the preceding regular conference, based upon data furnished by the National Federations regarding their aeronautical activities.

Voting by correspondence is not permitted but the committee may consult the National Federation by this means on questions calling for immediate solution.

Budget and Dues

Art. a-15. The budget of the F. A. I. consists of the assessments made on the National Federations.

Each year the Treasurer must have his budget for the succeeding fiscal period approved, as well as his report for the preceding fiscal period.

The Treasurer's budget and report shall be submitted to the conference by a committee of three members appointed at the opening of the first session.

The amount of the dues for the next fiscal period shall be based upon the budget—it being proportional to the number of votes allotted to each National Federation.

The fiscal period shall begin January 1 and end December 31 of each year.

No National Federation which has not paid into the treasury the amount of its annual dues shall have the right to vote at a conference.

Membership

Art. a-16. Applicants for membership in the F. A. I. shall present to the Secretary of the F. A. I. their report signed by the President and Secretary and accompanied by two copies of (a) their statutes; (b) rules and regulations for competitions and records; (c) models of medals; (d) licenses; (e) names of the officers and governors; (f) names of affiliated clubs or organizations.

Organizations Affiliated With the National Federations

Art. a-17. The National Federations must keep the Secretary of the F. A. I. informed of all changes occurring in the list of their affiliated societies; they may accept as affiliates only such societies as subscribe to these statutes and general regulations and their appendices.

When a National Federation permits the founding of a National Federation in one of its dependencies, dominions, protectorates, or colonies in accordance with the provisions of Article 1, it may not accept or retain as an affiliated organization any aeronautical society situated in the territory thus detached.

Sanctions

Art. a-18. Penalties pronounced by competent authority of any National Federation of the F. A. I. will be recognized and applied by all the Federations of the F. A. I.

Art. a-19. Any disqualification or suspension will apply with full force from the day on which the penalty shall have been declared and ratified, and all engagements made by the party in question, even those entered into prior to that date will be null and void.

Art. a-20. All the National Federations inflicting penalties will at once notify the Secretary of the F. A. I. who will transmit them to all the Federations, who will in turn transmit them to their affiliated societies, and to all persons under their jurisdiction.

Licenses and Certificates

Art. a-21. The F. A. I. gives each affiliated National Federation the power to issue (1) The F. A. I. brevet as aviator or aeronaut to those who qualify; (2) The annual license for contestants who are competent and in good standing.

No one shall act as pilot in a competition unless he is the holder of an F. A. I. license.

The F. A. I. license must be renewed annually, effective January 1, 1920.

Art. a-22. Each National Federation will issue licenses to its own citizens.

Art. a-23. A license may be issued under an assumed name; but no one may make use of more than one assumed name.

Art. a-24. The issuance of a license may be made dependent upon the payment of a fee, to cover the cost of issuance and renewal.

This fee must not be more than \$5.00.

Records

Art. a-25. The Secretary of the F. A. I. will keep up to date a list of National records, in accordance with documents submitted to him each quarter by the National Federations.

Art. a-26. World's records made in accordance with the rules and regulations of the F. A. I. will be recognized, and such records published each year by the Secretary of the F. A. I.

The list of world's records for the year close at midnight on December 31st. Records submitted cannot be recalled. However, records *established during the month of December will be included in the list for the year, if they are received by the Secretary of the F. A. I. before the 31st of January.*

Art. a-27. Notification of records, addressed to the Secretary of the F. A. I. must be signed by the president of the National Federation, and the Chairman of its Contest Committee. Reports by telegraph or telephone will not be recognized.

Amendments to Statutes and Regulations

Art. a-28. Amendments to the Statutes and Regulations may be passed by a two-thirds vote of the Federations represented in the Conference.

They must appear in the order of business,

A committee, known as the Committee on Statutes and Regulations shall be permanently constituted, its functions being to report at each regular Conference on questions concerning the Statutes and Regulations, their application and modifications, and proposed additions.

Dissolution-Liquidation

Art. a-29. The dissolution of the F. A. I. can only be effected by a four-fifths vote of the National Federations present at a Special Conference, called to consider this question, in accordance with the provisions of the first paragraph of Article 9 of these Statutes; the National Federations present must include two-thirds of the National Federations forming the F. A. I. at the time the vote is taken.

The dissolution having been determined by vote, the Bureau of the F. A. I. liquidates its assets which shall be distributed in equal parts to the National Federations making up the F. A. I. at the time the vote was taken.

Art. a-30. Under no other circumstances can any National Federation make claim for a distribution of the assets.

Jurisdiction

Art. a-31. Differences which may arise between (a) National Federations; (b) Affiliated organizations of a National Federation; (c) Members of a National Federation or of its affiliated organizations shall be decided as prescribed by the Statutes and Regulations of the F. A. I. provided that no National or International judicial body has been called upon to decide it.

Any National Federation or any affiliated organization, or any one within the jurisdiction of either of these bodies who shall take into the courts any controversy arising from the interpretation or application of these Statutes and Regulations, shall be liable to *expulsion, suspension or disqualification.*

F. A. I. RULES

**Rules and Regulations for Aeronautic
Events and Recognized
Record Trials**

PART I

GENERAL PRINCIPLES

Chapter II

ARTS. 1-2-3-4

{ Powers of the F. A. I.
Powers of the National Federation.
Sanctions.
Powers of the Contest Committee.

ART. 5

Organization of Aeronautic Events.

ART. 6

Optional Make-up of National Committees.

ART. 7

Obligation to know F. A. I. Rules.

ART. 8

Participants in "out-law" events disqualified.

ART. 9

Prize Money paid to Entrants.

ART. 10

Records credited to Pilot of the Aircraft qualified.

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CHAPTER II

GENERAL PRINCIPLES

Art. 1. The F. A. I. is the sole sporting authority in the world, empowered to make regulations for aeronautic events and records.

Art. 2. Such powers as are not solely vested in the conferences of the F. A. I. are delegated by the F. A. I. to the National Federation in each country.

Art. 3. Aeronautic events and records sanctioned by the National Federation are governed by the present regulations. All rules and programs must state this fact.

Each National Federation shall appoint a Contest Committee responsible for the compliance with and enforcement of the rules of the F. A. I.

Art. 4. The Contest Committee of the National Federation representing the F. A. I. in each country passes as a court of last resort upon differences that may arise between its nationals. Each National Federation has the power to appoint organizations to act for it in the first instance. (Example, sanctioned events.)

Every contestant belonging to a country not represented in the F. A. I. will be treated as a national of the country in which the meet is held, with the exception of those barred by the Statutes. (Statutes a-13.)

Art. 5. Aeronautic events must be organized by permanent or temporary organizations or associations known hereafter as "Race Committees."

Art. 6. Each National Federation may subdivide its Contest Committee into three sections, delegating to each the control of the Aeronautic events and records of its respective sections.

1st Section—Class A—Free balloons.

2nd Section—Class B—Airships (Dirigibles).

2nd Section—Class C—Motor aviation.

3rd Section—Class D—Motorless aviation.

3rd Section—Class E—Kites.

The National Federation may consolidate the three sections, or any two of them, into one. But appeals must be judged by all the sections joined together. (Art. 180.)

Art. 7. Everyone participating in the organization of a sanctioned aeronautic meet, and every contestant taking part in a sanctioned aeronautic meet, by so doing agrees (1) to know the present regulations thoroughly; (2) to submit without restriction to the consequences that result therefrom.

Art. 8. All aeronautic events not organized according to these regulations are forbidden; the organizers, the officials, and the contestants in such aeronautic events will be suspended or disqualified.

Art. 9. In trials, meets, or races, the prizes, or prize money will be given only to the person in whose name the entry is made. These persons may be fictitious personalities. (Exceptions made where special deed of gift accompanies trophies or cash prizes. Contest Committee, Aero Club of America.)

Art. 10. The record belongs personally to the pilot of the aircraft with which it was made. Announcements of a record must indicate the aircraft with which the record was established or broken.

PART II

AERONAUTIC EVENTS

Chapter III	Definitions Arts. 11 to 14	{ Classification of aeronautic events. Competitions. Meets. Races.
Chapter IV	Scope of Aeronautic events Arts. 15 to 18	{ Definition of scope. Open national events. Open international events. Closed events.
Chapter V	Nature of Aeronautic events Arts. 19 and 20	{ Nature of recognized aeronautic events not specifically covered by the present regulations.
Chapter VI	Events covering several countries Art. 21	{ Definition of the powers of organization, control and homologation.

CHAPTER III

DEFINITIONS

Classification of Aeronautic Events

Art. 11. Aeronautic events held under the present regulations, in conformity with the stipulations of Art. 3, shall comprise trials, meets and races.

Trials

Art. 12. A trial is an event controlled by regulations, in which prizes or awards may be given, and in which each competitor chooses the moment of execution within a period fixed by the regulations.

Meets

Art. 13. A meet is a competition or a number of competitions in which several contestants take part; the time and place of which are fixed by the regulations.

Races

Art. 14. A race is a competition in which speed is the only factor for classification.

CHAPTER IV

SCOPE OF AERONAUTIC EVENTS

Definition of Scope

Art. 15. Aeronautic events are either national or international. They may be opened or closed.

Open National Events

Art. 16. Open national events are those in which any person may take part who belongs to the country of the National Federation that organizes or sanctions it, and who is qualified under the present regulations.

Open International Events

Art. 17. An open international event is one in which any person qualified under these regulations may take part, no matter what his nationality.

Closed Events

Art. 18. A closed event is one in which the contestant must satisfy special conditions stipulated in the regulations by the Race Committee.

A closed event may be national or international, but in the latter case only the national code applies.

Private events organized by a Club, and restricted to its own members, are classified as closed events.

CHAPTER V

NATURE OF AERONAUTIC EVENTS

Nature of Recognized Aeronautic Events

Art. 19. Events of the same nature as those accepted for record by the F. A. I. in which distance, speed, duration, or altitude serve as a basis for classification, shall be recognized aeronautic events.

Aeronautic Events Not Specifically Covered by the Present Regulations

Art. 20. In addition the Contest Committees of National Federations may admit or allow events of other sorts upon the request of the Race Committee.

CHAPTER VI

EVENTS COVERING SEVERAL COUNTRIES

Definitions of the Powers of Organization, Control and Homologation

Art. 21. Whenever an event shall extend over the territories of several nations, the control shall belong to the National Federation of the country of initial departure, no matter what may be the country of arrival.

The homologation of the results of such international events shall be pronounced by the Contest Committee of the National Federation of the country of departure.

However, the consent of the National Federation of each interested country is mandatory. This consent shall be requested by the National Federation of the country of departure, through the Secretary-General of the F. A. I.



PART III

AIRCRAFT

Chapter VII

Classification of
Aircraft
Arts. 22 to 33

Classes.
Right to classification.
Class A.
Categories.
Determination of volumes.
Permissible variation of volumes.
Classification into categories of free
balloons inflated with other than
illuminating gas.
Class B.
Class C.
Class D.
Class E.
Doubtful classifications.

CHAPTER VII

CLASSIFICATIONS AND DEFINITIONS OF AIRCRAFT

Classes

Art. 22. Events and records are classified according to the nature of the aircraft, as follows:

Class A—Free balloons.

Class B—Airships (Dirigibles.)

Class C—Airplanes (Motor aviation.)

Class D—Gliders (Motorless aviation.)

Class E—Kites.

Power to Classify

Art. 23. The National Federation is the sole judge of the classification of all aircraft as well as of all questions which may arise under this head.

Free Balloons

Art. 24. A form of aerostat deriving its support in the air from the buoyancy of the air displaced by an envelope the form of which is maintained by the pressure of a contained gas lighter than air, and having no power plant or means of controlling the direction of flight in the horizontal plane.

Categories

Art. 25. In "Class A" balloons inflated with illuminating gas are divided into the following categories. (Art. 27.)

1st category: Balloons of 600 cubic meters and below (21,189 cu. ft. and above.)

2nd category: Balloons of 601 to 900 cubic meters (21,224 to 31,783 cu. ft.)

3rd category: Balloons of 901 to 1200 cubic meters (31,818 to 42,377 cu. ft.)

4th category: Balloons of 1201 to 1600 cubic meters (42,412 to 56,502 cu. ft.)

5th category: Balloons of 1601 to 2200 cubic meters (56,538 to 77,691 cu. ft.)

6th category: Balloons of 2201 to 3000 cubic meters (77,726 to 105,943 cu. ft.)

7th category: Balloons of 3001 to 4000 cubic meters (105,978 to 141,258 cu. ft.)

8th category: Balloons of 4001 and above cubic meters (141,293 cu. ft. and above).

Determination of Volumes

Art. 26. The cubical contents of free balloons are established by the tables appended to these regulations. (See appendix No. 1.) They follow from the equatorial and meridional dimensions if possible. In other cases they are defined by the geometric forms.

Permissible Variation of Volumes

Art. 27. A variation of five per cent is allowed; consequently there can be considered as belonging to a given category, balloons exceeding by five per cent the maximum, or falling below by five per cent the minimum volume of that category. In these cases the competitor will be allowed to choose in which of the two categories he wishes to compete.

Classification of Free Balloons Inflated With Other Than Illuminating Gas, Into the Categories

Art. 28. The category of free balloons inflated with other than illuminating gas shall be determined by the volume of a balloon filled with illuminating gas having the same ascensional force. The ascensional force of illuminating gas shall be taken as 0.7 kilograms per cubic meter.

In figuring the fictitious volume (f. v.) which will determine the category of any balloon filled with other than illuminating gas (il. g.) multiply the true volume (t. v.) of the balloon by the ratio of the ascensional force of the gas actually used (g. u.) to fill the

GU
IL. G.

balloon and that of illuminating gas (il. g.) i. e. $(TV \times \frac{GU}{IL. G.} = FV)$

Example: A balloon of 1500 cubic meters, inflated with hydrogen, which has an ascensional force of 1.05 kg., using the formula,

$1500 \times \frac{1.05}{0.70} = 2,250$,—corresponds to a balloon of 2.250 cubic

meters filled with illuminating gas which has an ascensional force of 0.7 kg; this balloon filled with hydrogen would then fall within the 6th category. (Art. 25.)

Class B Airships

Art. 29. A form of aerostat provided with a propelling system and with means of controlling the direction of movement.

Class C Airplanes

Art. 30. A form of aircraft heavier than air which obtains support by the dynamic reaction of the air against the wings and which is driven through the air by a screw propeller. This term is commonly used in a more restricted sense to refer to airplanes fitted with landing gear suited to operation from the land. If the landing gear is suited to operation from the water, the term "seaplane" is used. (See glossary.)

Class D Gliders

Art. 31. A form of aircraft similar to an airplane, but without any power plant.

Class E Kites

Art. 32. A form of aircraft without other propelling means than the towline pull, whose support is derived from the force of the wind moving past its surface.

Doubtful Classification

Art. 33. In the event of any aircraft not falling clearly within one of these five classes, the Contest Committee of the National Federation will determine the class in which it shall be placed.

This decision shall be without appeal.

PART IV

PERSONNEL

Chapter VIII	Contest Committees of the National Federation ARTS. 34 to 36	<ul style="list-style-type: none"> Relations with the F. A. I. Duties. Delegating of the powers of the Contest Committee.
Chapter IX	Race Committees ARTS. 37 to 44	<ul style="list-style-type: none"> Designation. Composition. Duties. Appointment of Contest and Race Officials. Appointment of Officials for trials. Data to be submitted in order to Obtain a Sanction. Request for Sanction. Race Papers, approval of
Chapter X	Officials ARTS. 45 to 66	<ul style="list-style-type: none"> List of Officials. Participation of Officials in Aero-nautic Events. Competent Officials. Distinctive Insignia. Duties. Applications of the Decision, Appeals. Referee's right to levy penalties. Appointment of Assistant Officials. Timers, appointment of. Requirements for the Appointment of Timers. Admission of Officially recognized Timers. Renewal of stop-watch Certificates. Official certification of timing. Timers, to whom responsible. Duties and distinctive Insignia. Official timing report. Formalities connected with timing. Timing unsanctioned. Events forbidden. Sending in the Official time sheets. Requests for Timing. Charges for Timing. Penalties levied for professional misconduct.

Chapter XI

Aviators
Arts. 67 to 72

- Licensed Aviator required.
- Aviators' certificates.
- Renewal of Aviators' certificates.
- Aviator's license.
- Application for a license.
- Validity and withdrawal of license.

Chapter XII

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Arts. 73 to 91

- Aviator contestants.
- Contestants who are not Aviators.
- Time allowed for designation of Aviators.
- Relays of Aviators.
- Pseudonyms.
- Change of pseudonym.
- Abandonment of pseudonym.
- Right to protest.
- Method of protesting.
- Time in which protests may be lodged.
- Directing the protests.
- Protests after homologation.
- Withholding of prizes in case of protests.
- Simmons.
- Rejection of a protest notification.
- Obtaining Officials for trials.
- Simultaneous entries.
- Descent into the sea.
- Advertising on the aircraft.
- Misleading publicity.
- Publicity before homologation.

CHAPTER VIII

CONTEST COMMITTEES OF THE NATIONAL FEDERATIONS

Relations with the F. A. I.

Art. 34. The National Federation alone shall be qualified to correspond with the F. A. I. (International Aeronautic Federation.)

Duties

Art. 35. (a) The principal duties of the Contest Committees are as follows:

(b) To enforce with supreme authority the present regulations;

(c) To approve and enforce the national regulations promulgated by the National Federation;

(d) To provide for the management and control of all the events that take place in their territory, as also of those carried out over an international course, of which their National Federation may have charge;

(e) Acting as a lower court of appeal to settle all differences that may arise in connection with contests taking place in their territories, or of which their National Federation has charge, between nationals of the different countries represented in the F. A. I. (Art. 6.)

(f) To act as a court of last resort under the same conditions if the interested parties are their own nationals, or naturalized; (Art. 6.)

(g) To examine the regulations and the programs of contests and to approve same, with or without modification;

(h) To ratify the results if the case require;

(i) To keep up to date the list of persons suspended or disqualified and to make sure that these do not participate in any event. This list shall be sent by the National Federation to the office of the Secretary of the F. A. I. every time any change has been made in it;

(j) To pronounce officially on the admissibility of contestants;

(k) To designate or approve officials;

(l) To keep up to date the list of officials;

(m) To appoint timekeepers and assistant timekeepers; to revise the list of these every year;

(n) To give official ratification to the records recognized by the F. A. I.

- (o) To impose and apply the penalties provided in the present regulations;
- (p) To issue licenses;
- (q) To issue sanctions.

Delegating of the Powers of the Contest Committee

Art. 36. The Contest Committees of the National Federation shall have the right to delegate all or a part of their powers to organizations affiliated with them, for the purpose of management and control of contests, as also for the enforcement of penalties.

This delegating power does not extend to the appeals.

CHAPTER IX

RACE COMMITTEES

Designation

Art. 37. The following are recognized as Race Committees:

1. The National Federations.
2. Their adherents, or those affiliated with them.
3. The temporary groupings named by the National Federations or their adherents or affiliations for any given contest.
4. The temporary independent groupings that shall have secured a sanction issued by the Contest Committee of the National Federations.

Composition

Art. 38. Race Committees are not allowed to include in their membership anyone who has been suspended or disqualified in any sport, according to notice published by a recognized Federation.

Duties

Art. 39. The duties of the Race Committee are as follows:

1. To apply for the sanction if necessary.
2. To prepare the programs and regulations of the tests, contests or races.
3. To prepare the final list of contestants admitted, after receipt of favorable advices from the Contest Committees of the National Federations.
4. To prepare all papers relating to the event.
5. To establish measures and execution of regulations to insure safety.
6. To designate the personnel charged with general organization and, ultimately, the officials.
7. To provide for timing.

Appointment of Contest and Race Officials

Art. 40. For meets and races, Race Committees may propose to the Contest Committee of the National Federation, the appointment of officials, but the Contest Committee may always limit their number, impose officials of its own selection, or further ~~de~~ *mand* that new proposals be made to it.

Appointment of Officials For Trials

Art. 41. For trials, the Race Committees may name directly one or several competent officials chosen from the lists drawn up by the Contest Committee of the National Federation.

Data To Be Submitted In Order to Obtain a Sanction

Art. 42. The following information must accompany the application for a sanction.

Names, status, and addresses of the proposed members constituting the Race Committee, and its office address.

Request for Sanction

Art. 43. The application for the sanction mentioned in Par. 4, Art. 37, is obligatory; it implies, on the part of any Race Committee that formulates it, unreserved acceptance of the present regulations, as well as of the National regulations.

Race, Papers, Approval of

Art. 44. Race Committees must send, for approval, to the Contest Committee of the National Federation, after having obtained the temporary sanction the following items, at least three days before the date of their publication:

1. List of entries.
2. Names of officials.
3. Three copies of the program.
4. Three copies of each of the regulations.
5. A description of the terrain over which the events will take place, accompanying it, when involving events of the classes B, C, D, E, by a map to the scale of 1/50,000 at least.

CHAPTER X

OFFICIALS

List of Officials

Art. 45. The groups of officials composing the Race Committee are as follows:

1. Members of the Contest Committee and Members of the Technical Committee.
2. Officials especially appointed, i. e., Referee, Judges, Starters, Chief Scorers, Police, Medical and Publicity.
3. Assistant Officials especially appointed—Assistant Starters, Assistant Scorers, etc.
4. Timers.
5. Assistant Timers.

The above are known under the designation of "officials."

Participation of Officials in Aeronautic Events

Art. 46. At no time during an event may an official go on board an aircraft except in the discharge of his duties and upon the order of a competent official, as described by Art. 45, Par. 1.

Competent Officials (See Art. 45, Par. 1)

Art. 47. Each year the Contest Committee of the National Federation prepares a list of persons who are to exercise control duties in the tests, races or competitions. These persons are known as "competent officials."

This list of officials may be revised every year, and is subject to modification during the year.

The name Referee designates any official in charge of the control of any race or competition.

The name "directing official" designates the one who directs the control operations in a test.

The name "assistant official" designates any official assisting the two above named.

Distinctive Insignia

Art. 48. Members of the Race Committee will wear as insignia arm bands of the following colors on which their title and the date of the event shall be printed: Referee, purple; Judges, blue; Starters, yellow; Timers, green; Medical, red cross; Scorers

green; Contestants and Mechanics, brown; Members, Contest Committee, red; Members, Technical Committee, gray; Guests and Press, white; Communication and Police, black.

The Contest Committee have substituted above rule for that of the F. A. I. which states "Contest Committee wear a red arm band with a gold border, bearing the name of the Club to which they belong. Special officials or assistants wear a red and blue arm band bearing the name of the National Federation," which seemed inadequate due to the difficulty of maintaining police lines and locating the proper officials on a large airdrome.

Duties

Art. 49. The duties of the Referee and Directing Officials are as follows:

1. To see that the program of events is carried out, and that the regulations are enforced and respected by Race Committee, officials, entrants, contestants, their assistants and passengers.
2. To take all necessary measures to insure the genuineness of the aeronautic events in question.
3. To make all decisions relative to claims and protests.
4. To make up the file of documents covering the events.
5. To prepare the final report covering the meets and races and to submit the results thereof to the Contest Committee of the National Federation, for official ratification.

Application of the Decisions. Appeals

Art. 50. The decisions of the officials will be immediately carried out. However, an appeal may lie against them as set forth in Article 178.

Referee's Right to Levy Penalties

Art. 51. Referees are empowered to impose penalties in conformity with the provisions of Arts. 163, 165, 169, 172.

They may, moreover, request the Contest Committee to apply severer penalties.

Appointment of Assistant Officials

Art. 52. Contest or Special Officials are always authorized to designate the Assistant Officials who are to aid them; the selection is made from the list mentioned in Art. 47.

In the event of urgency, however, they may be chosen otherwise than from this list.

Timers, Appointment of

Art. 53. The Contest Committee of the National Federation appoints the Timers and Assistant Timers for the current year, and places their names on the list of officials.

Requirements for the Appointment of Timers

Art. 54. In order to be appointed, the official Timers and Assistant Timers must:

1. Pass an examination, the program of which is fixed for each of the two categories by the F. A. I., and subject to revision by it. (See Addenda to Rules.)
2. Prove that he owns, or has received from a Club, a split-second, fly-back stop watch, accompanied by a certificate of the first class issued by one of the official observatories recognized by the Contest Committee of the International Federation.

Admission of Officially Recognized Timers

Art. 55. The Contest Committees of the National Federations have the right to admit without examination formalities the Timers recognized by the governing bodies of another sport.

Renewal of Stop-Watch Certificates

Art. 56. Every two years the holders of chronometers (privately owned or placed at their disposal by clubs), must have their chronometer certificate renewed, or furnish a new and special certificate as to their functioning.

Official Certification of Timing

Art. 57. (Aircraft of Classes B and C) (Airships, Airplanes.) For duration, and speed records, also in such trials, races or contests as are decided exclusively on duration or on speed, the time-measurement must be taken by an official Timer provided with a regulation stop-watch, and entered upon a time sheet drawn up and signed by him, excepting in the cases mentioned in Arts. 61, 127 and 140.

Timers, to Whom Responsible

Art. 58. Timers and Assistant Timers are wholly independent of the Race Committee and are exclusively subject to the orders of the Contest Committee or Referee.

Duties and Distinctive Insignia

Art. 59. The following are the duties of Timers and Assistant Timers:

1. Take the exact instant of departure and, if necessary, of arrival. The time is always the official time of the country in which it is taken.
2. To record the times thus taken in the form of an official report (time sheet, Art 57).

Timers and Assistant Timers wear a green arm band bearing the word "Timer" or "Assistant Timer."

Official Timing Report

Art. 60. The report drawn up by the Timer, or Assistant Timer, has the force of law in classifying competitors and in homologating results. Every Timer or Assistant Timer must always sign the official reports covering the events, or the time measurements he has taken.

Formalities Connected With Timing

Art. 61. Any Timer or Assistant Timer who signs a sheet not drawn up by him, or who takes the time with an unregulated watch, shall be relieved of his duties; and such disqualification may entail, upon the decision of the Contest Committee of the National Federation, the refusal to ratify the records taken.

However, in closed national aeronautic events (Art. 18), the Timer or Assistant Timer may be authorized by the Contest Committee to avail himself of the help of assistants who are not officially qualified Timers and who are not provided with the official stopwatch; also to countersign the times thus taken, with the express reservation that these Timers may under no circumstances serve as the basis for the ratification of records.

Timing Unsanctioned Events Forbidden

Art. 62. Any Timer or Assistant Timer who has acted for a contestant under suspension or disqualification, or for a Race Committee not provided with a sanction, shall be suspended from his duties for a period of time to be fixed by the Contest Committee of the National Federation.

In case of the repetition of the offense the suspension must be made permanent.

Sending In the Official Time Sheets

Art. 63. Timers and Assistant Timers must transmit their official reports to the officials to whom they report.

Requests for Timing

Art. 64. Requests for the services of Timers must be sent to the Contest Committee of the National Federation.

Charges for Timing

Art. 65. The Contest Committee of each National Federation must prepare a schedule or tariff of rates for Timers' services for each class of Timer; this shall be binding upon the interested parties.

Penalties Levied for Professional Misconduct

Art. 66. Timers and Assistant Timers may be suspended for misconduct of a professional nature or involving a reflection upon their honor.

This penalty, however, shall not become final until after the accused shall have had a regular hearing or shall have been regularly summoned by the Contest Committee of the National Federation.

CHAPTER XI

AVIATORS

Licensed Aviator Required

Art. 67. No aircraft of Classes A, B, C and D (Art. 6) may participate in an aeronautical event or be used to establish a record unless it is piloted or commanded by a certified aviator, who is required to be on board and provided with the license issued by the Contest Committee of the National Federation.

Aviators' Certificates

Art. 68. Aviators' certificates constitute attestations of professional ability and do not relieve the holder from the obligation to possess a license.

Recognition of Aviators' Certificates

Art. 69. The F. A. I. publishes annually, if necessary, the conditions upon which it delivers or recognizes aviators' certificates.

Aviator's License

Art. 70. Any person provided with an aviator's certificate recognized or delivered by the F. A. I. may secure the "License" which the Contest Committee of each National Federation is empowered to issue optionally to its own nationals or persons naturalized. This license constitutes the sole title by which a "qualified" aviator is permitted to pilot an aircraft in the aeronautical events governed by the present regulations.

Application for a License

Art. 71. Applications for licenses must show the following:
Name, with first name; date of birth; nationality; origin and number of the aviator's certificate.
Every application must be accompanied by the aviator's certificate.

Validity and Withdrawal of License

Art. 72. The license possesses validity as provided in Art. 21 of the statutes.

It may not be withdrawn temporarily or permanently, by a Contest Committee except with the consent of the National Federation to which the license in question belongs.

CHAPTER XII

CONTESTANTS

Aviator Contestants

Art. 73. Every holder of an aviator's license who participates in aeronautical events governed by the present regulations, qualifies as a "contestant" by virtue of entering for such event.

Contestants Who Are Not Aviators. Time Allowed for Designation of Aviators. Relays of Aviators.

Art. 74. "Contestant" is likewise the designation of any person who makes entry and does not himself function as an aviator. In the event that this person is not the holder of the license the entry must show the name of the DESIGNATED AVIATOR who has charge of the aircraft, and the number of the latter's license.

The regulations governing aeronautical events may, however, grant in this case a period of time for the designation of the aviators, which period must expire not later than eight days prior to the beginning of the events.

Contestants shall up to this time have the right to designate a number of aviators, from which number they may finally make a definite selection. The regulations must stipulate the time at which the Race Committee must be informed of the choice made.

The regulations may likewise authorize the use of several aviators acting in relays and coming aboard during the course of the event, but on condition that no one of these shall be the contestant.

Pseudonyms

Art. 75. Any contestant desiring to employ a pseudonym must address an application, stating the grounds thereof, to the Contest Committee delivering the license; the latter document shall, in this case, mention the pseudonym that has been authorized.

Change of Pseudonym

Art. 76. A change of pseudonym involves compliance with the same formalities as in the case of obtaining one.

Abandonment of Pseudonym

Art. 77. The person who has been authorized to assume a pseudonym may not resume the use of his own name until a new decision has been handed down by the Contest Committee that is to issue to him a new license.

Right to Protest

Art. 78. The right to protest is possessed by contestants only; the officials, however, may always act by virtue of their office even when no protest has been filed.

Method of Protesting

Art. 79. Protests will be considered only when presented in writing and accompanied by the sum of ten dollars (\$10.00) which amount shall not be refunded unless the validity of the protest is recognized.

Time In Which Protests May Be Lodged

Art. 80. All protests must be sent in to the Contest Committee not later than five days after the close of the aeronautic event unless there is a special stipulation in the regulations to the contrary.

However, in order to be admitted:

- (a) Complaints relating to the classification of the aircraft (weighing, taking of measurements, markings, etc., etc.) to the validity of entries, to the qualifications of aviators or contestants, must be presented before the opening of the event, or, in tests, before the start.
- (b) Protests concerning the course, measurement, placing of landmarks, etc., must be filed twenty-four hours before the opening of the event.
- (c) Protests concerning the regularity of a contestant's performance (going out of the course, modification of the conditions of handicap, etc., etc.) must be filed within twenty-four hours *after the termination of the event.*

Directing the Protests

Art. 81. In the absence of Contest Officials, protests are addressed, within the same periods of time, to the Contest Committee at the Central office of the National Federation.

Protests After Homologation

Art. 82. Any protest relative to the homologated results of an aeronautic event must be addressed to the Contest Committee within one week from the date of such homologation.

Withholding of Prizes In Case of Protests

Art. 83. The prize won by the contestant who is involved in a protest is withheld until a final decision has been rendered concerning such protest.

Summons

Art. 84. The party involved in a protest must be duly summoned and given a hearing within a period of time determined by the Contest Committee. If he fails to present himself at the time fixed upon, he may not plead such absence against the decision that was rendered in the case.

Rejection of a Protest Notification

Art. 85. Notice of the rejection of a protest must be given in writing to the protestant at the address which must be set forth in the protest itself.

Obtaining Officials for Trials

Art. 86. In aeronautic events known as trials, the contestant is required to secure the services of the officials subscribed in the regulations, and to call upon them of his own volition.

Simultaneous Entries

Art. 87. No contestant, who voluntarily gives up participation in an aeronautic event, for which he has made entry, is allowed to take part in any capacity whatever in any other aeronautic event taking place at the same date or within the same period of time.

Descent Into the Sea

Art. 88. Any contestant who descends into the sea and is obliged to have recourse to a boat in any manner whatever, is out of the race *without penalty*, unless the particular regulations contain a *provision to the contrary*.

Advertising On the Aircraft

Art. 89. Contestants are forbidden to have displayed upon their aircraft or equipment any commercial advertising, except the trade mark of the constructor of the aircraft.

Misleading Publicity

Art. 90. Penalties may be applied to any competitor who upon the occasion of any sporting event whatever shall have given out false information altering the facts of the case.

Publicity Before Homologation

Art. 91. Nothing may be made public relative to a performance before the homologation of this performance by the Contest Committee; but a protest, however, does not suspend the right of publicity.

PART V

ORGANIZATION OF CONTESTS AND TRIALS

Chapter XIII	Preliminary Steps ART. 92 to 97	{ Preparation and approval of the regulations. Drawing up the regulations. Validity of entries. Changes in the rules—new prizes. Sending of rules. Preparation of programs.
Chapter XIV	Entries ART. 98 to 110	{ Formalities of entry. One person per entry. Paying the entry fee. Closing of entries in international events. Late entries. Rule for entries. Refunding of entry fee. Forfeiture of fees. Forfeiture. Admissibility of entries. Communicating entry list to contest committee. Elimination of contestants. Designation of contestants starting.
Chapter XV	Course ART. 111 to 116	{ Approval of terrains. Approval of aerodromes. Refusal to accept grounds or aerodromes. Marks and circuits. Fouling a mark. Site and surface.

		<ul style="list-style-type: none"> Right of supervision of members of contest committee. Refusal or cessation of control. Control out of sight of the officials. Rules covering instruments. Defective functioning of a control device. Special rules covering control in Class A. (Balloons.) Incompetency of a competitor. Handicap. Point of arrival not fixed. Preparation of documents in case point of arrival is not fixed. Certificates of the log. Preparation of landing certificates. Case where official certification of documents is impossible. Agreement of hours. Documents furnished. Telegrams. Declaration under oath. Optional measures of control. Supplementary investigations. Definitions of starts. Regulations governing starts. Landing. Involuntary stops. Final landing. Arrivals. Measurement of distances. Highest speed record. Determining the distances—circuit with pylons—closed circuit.
Chapter XVI	Control Art. 137 to 143	<ul style="list-style-type: none"> Documents. Mention of records. Time allowed for transmitting the files. Reports. Preparation of reports.
Chapter XVII	Closure Art. 144 to 148	
Chapter XVIII	Homologations Art. 149 to 151	<ul style="list-style-type: none"> Authority of homologation. Delays. Promulgations.
Chapter XIX	Prizes Art. 152 to 154	<ul style="list-style-type: none"> Delay in the transmission of prizes. Postponement of transmission of prizes. Deposits in the case of appeal to the F. A. I.

CHAPTER XIII

PRELIMINARY STEPS

Preparation and Approval of the Regulations

Art. 92. Every meet will require the preparation of a set of rules which must not be published before its approval by the Contest Committee of the National Federation, or else by the authority declared competent by virtue of Article 36.

Drawing Up the Regulations

Art. 93. Rules and regulations for sanctioned meets submitted to the Contest Committees of the National Federation for their approval must necessarily contain all the information set forth below, in the following order:

1. Definition of the event (trial, meet, race) and its nature (distance, duration, altitude, point of landing, etc.);
2. The name under which the event is to be designated, if necessary;
3. The statement that the regulations are drawn up in conformity with the provision of the general regulations of the F. A. I. and of the Contest Committee of the National Federation, on whose territory the event is to take place, or to start in case the event takes place over an international course;
4. The detailed statement of the conditions under which the event is to be carried out (number of passengers, surcharge, handicap, etc.);
5. The specifications of the classes of aircraft admitted, and the categories in each class, if necessary;
6. An accurate and detailed statement of the number of prizes for each event, and of the amounts thereof;
7. The maximum or minimum number of contestants admitted in each event, and the method of elimination employed in the case of an excess number of entries;
8. The scope of the event (national, international, open, closed);
9. The amount of the entrance fee and of the forfeits if any;
10. (a) The place, the date, and the hour of opening and closing entries for races and meets;
(b) The time limits in which entries can be received for trials;
11. The exact specifications governing the material for the aeronautic event (receipt and examination of aircraft, etc., day, hour, etc.);
12. The conditions governing the start (date, hour, place, etc.);
13. The direction in which the course is to be run, if necessary;
14. The statement of the requirements for the contest and methods of ascertaining them. (Factor of safety, minimum speed, etc.);

15. Obligations imposed upon contestants (colors, numbers, marks);
 16. The conditions under which arrivals must take place, if necessary;
 17. The names of the Contest Officials, if no program is published.
- None of the above requirements may be omitted.

Validity of Entries

Art. 94. Should occasion require, in case of trials, the rules must indicate the time within which the entry shall hold good.

Changes in the Rules; New Prizes

Art. 95. No changes may be made in the rules after their publication without the consent of the Contest Committee of the National Federation, and these changes must be published before the day of opening the entries.

Nevertheless, with the approval of the Contest Committee, new prizes may be added to the program during a meet, but without producing any modification in the regulations.

Sending of Rules

Art. 96. When an entry is accepted, the contestant shall be sent a copy of the rules for the events in which he has made an entry. He will be supposed to know these (the F. A. I.) regulations perfectly.

Preparation of Programs

Art. 97. The preparation of programs lies with the Race Committee and these programs must necessarily contain the following information:

1. The Composition of the Race Committee;
2. The names of the Contest Officials;
3. The list, the order, the date and hour of the events;
4. The list of competitors, with their numbers.

CHAPTER XIV

ENTRIES

Formalities of Entry

Art. 98. Contestants enter personally for every event in which they wish to participate; communicating such entry:

1. In writing;
 2. By telegram, confirmed by a letter of the same date.
- The entry or its confirmation must bear the contestant's signature.

One Person Per Entry

Art. 99. Each single entry cannot be made by more than one person.

Paying the Entry Fee

Art. 100. Every entry, or the confirmation thereof by letter if the entry is sent in by telegram, must be accompanied by the amount of the entry fee; otherwise such entry is null and void.

Closing of Entries in International Events

Art. 101. In the case of international meets the interval between the closing of the entries and the date of the meet shall not exceed three months.

Late Entries

Art. 102. Any entry arriving after the closing of enrollments shall automatically become null and void.

Rule for Entries

Art. 103. The entry must give the number of the aviator's license, and where issued,—barring stipulation to the contrary in conformity with the provisions of Art. 74.

Refunding of Entry Fee

Art. 104. The regulations shall state whether the amount of the entry fee established by the Race Committee is or is not reimbursable to parties starting in the race.

The amount of this fee, however, is properly reimbursable:

1. To the contestant who has not been declared admissible;
2. To the contestant whose entry has been eliminated by the drawing of lots or by reason of order of enrollment.

Forfeiture of Fees

Art. 105. If reimbursable entry fees are not withdrawn within the period of three months, same may accrue to the Race Committee.

Forfeiture

Art. 106. In the case of declaration of forfeiture the amount of the entry fee may be retained either in whole or in part under the conditions that are stipulated in the regulations.

Admissibility of Entries

Art. 107. Entries are final only after having been declared admissible by the Contest Committee of the National Federation and then actually admitted by the Race Committee.

Communicating Entry List to Contest Committee

Art. 108. The list of entries must reach the Contest Committee of National Federation within twenty-four hours after the official closing of entries.

Elimination of Contestants

Art. 109. In cases where the Contest Committee of the National Federation decides upon the elimination of a contestant, it shall not be required to state the reasons for such elimination.

Designation of Contestants Starting

Art. 110. If the number of contestants fulfilling the conditions required for admission exceeds the maximum number of contestants fixed by the regulations, the contestants starting shall be designated according to the order in which the entries have been enrolled, or by the drawing of lots.

CHAPTER XV

COURSE

Approval of Terrains

Art. 111. For any aeronautic event the general conditions of course and territory traversed must be approved by the Contest Committee of the National Federation and, in all cases, in accordance with the official rules.

Approval of Airdromes

Art. 112. No meet shall be authorized on an aerodrome if the ground does not satisfy the conditions specified by the National Federation.

Refusal to Accept Grounds or Airdromes

Art. 113. If by reason of the number of competitors, or of surrounding obstacles, or if for any other reason, the lay of the ground shall not be considered suitable, the Contest Committee of the National Federation may, notwithstanding the observance of the prescriptions laid down in the preceding article, refuse to accept the grounds and the aerodromes proposed.

Marks and Circuits

Art. 114. Whenever a circuit consists of a track in the form of a closed polygon without re-entrant angles, the vertices of the polygon will be marked by pylons.

Contestants in making turns, must pass completely outside the pylons, taking them always on the same hand, which will be indicated by the rules.

In the case of open or closed circuits with re-entrant angles contestants will be required to turn the pylons on the side of the vertex of the angle.

Fouling a Mark

Art. 115. Any competitor who has failed to turn a pylon properly may validly continue on the circuit provided he makes a complete turn of the said pylon and then continues his course in the proper direction.

Site and Surface

Art. 116. The terrain must be completely open, easy of approach, not surrounded by trees, houses, or other obstacles (drill grounds, race courses, etc.), and as near a railway station as practicable.

NATURE OF THE GROUND. The ground must be free from obstacles, practically level, and must allow an automobile to pass over it at a minimum speed of (20 miles per hour).

CHAPTER XVI

CONTROL

Right of Supervision of Members of Contest Committee

Art. 117. The individual members of the Contest Committee of the National Federation have the right of supervision over all events controlled by the present regulations.

On presentation of their visiting cards, insignia, or brassards, they will be admitted wherever an event is organized under the regulations.

The brassard of the F. A. I. will be violet embroidered in gold.

Refusal or Cessation of Control

Art. 118. In a trial the directing official (Art. 47) has full authority to exercise control over the terrain within the limits of the regulations in force. He also has the right to refuse or discontinue control of the trial whenever he shall judge proper.

Control Out of Sight of the Officials

Art. 119. Whenever, in an event, aircraft may for any reason whatsoever be compelled to execute all or a part of their circuit out of sight of the officials the latter will impose upon the competitors such measures as may seem suitable to insure proper control, even beyond the means provided in similar cases by the regulations.

Rules Covering Instruments

Art. 120. For any aeronautic event the contestant may be compelled to provide himself with control devices, sealed or not by the officials. The Contest Committees have the right to prescribe what model of apparatus shall be used or to approve those the contestants shall offer.

The Contest Officials have the right to interchange among the contestants the control apparatus brought by them.

If it becomes necessary, the contestant shall be obliged to mount the instruments anew, in accordance with the instructions that shall be given him before the start.

Defective Functioning of a Control Device

Art. 121. In case of defective working of a control apparatus, the official is entitled to annul the whole or part of the performance in question, no matter from where such apparatus may have come.

Special Rules Covering Control in Class A (Balloons)

Art. 122. For sporting events of Class A contestants must deliver or send to the Race Committee within twenty-four hours subsequent to landing, and by registered mail, and in every case by earliest delivery possible from post office or from the nearest railway, all the control documents prescribed by the regulations; they must bring or send, under the same conditions as to time, the registering or control instruments, taking all precautions to see that they arrive intact.

The contestant is responsible for the arrival of the documents into the hands of the Race Committee, in the specified time.

Incompetency of a Contestant

Art. 123. If in an event a competitor shall have shown himself notoriously incompetent the officials shall inform the Contest Committee which may then order the temporary withdrawal of his license and his exclusion from the event.

Handicap

Art. 124. Handicapping is permitted; it must have for its object the greatest possible equalization of the chances of the competitors.

Regulations of handicapped events must define, in a precise manner, the method of handicapping chosen as well as the methods of control adapted to insure their equity.

Contest Committees of National Federations have complete power to accept or refuse the methods of handicapping proposed, and to impose such additional measures of control as they may think advisable.

Point of Arrival Not Fixed

Art. 125. In every event in which the point of arrival shall not have been fixed, the place of landing and the exact moment of this landing will be determined by the control documents to be drawn up by the competitor and obligatorily addressed, within the time limits imposed, to the Race Committee.

These documents shall contain, under pain of nullity:

- (a) The log (model appendix No. 3a, b, c).
- (b) Certificate of landing (model appendix No. 4).

Preparation of Documents In Case Point of Arrival Is Not Fixed

Art. 126. The documents mentioned in Article 125 must be in scrupulous conformity with the instructions therein mentioned. The hours must be indicated in accordance with those of departure registered by the watch of the competitor, which must have been set to agree with the watch of the Timer, or if this is impossible, *with that of the official*; or, finally with the official time of the place of departure.

Certification of the Log

Art. 127. The log is obligatorily signed by the competitor who certifies that his declarations are true and must be countersigned by the aides or passengers with the following note:

"The aides and passengers traveling on board the balloon controlled by Mr. _____, certify that the declarations stated above are correct in whatever concerns the ascension of the _____."

The log must be kept with ink or indelible pencil.

Preparation of Landing Certificates

Art. 128. The certificates of the witnesses of the descent or of the landing must give the information indicated in the printed form of the Landing Certificate, (appendix No. 4).

Case Where Official Certification of Documents Is Impossible

Art. 129. If the signature or seal of a municipal magistrate or agent of the authorities, or of a railway, cannot be placed upon the landing certificate, especially in the case of descents, the fact will be mentioned in the document with the attestation of the witnesses as to the descent or of the landing.

Agreement of Hours

Art. 130. The competitor will indicate if the time mentioned in the landing certificate is in accord with that of the place of descent or of departure.

Documents Furnished

Art. 131. The Contest Committees must keep printed forms of the log and landing certificate at the disposition of interested parties, but nonfulfillment of these requirements will not excuse competitors from drawing up these two control documents in the prescribed form.

Telegrams

Art. 132. As soon as possible after the final descent, competitors will be required to send a telegram to the Race Committee indicating briefly the hour, the place of the descent, and the name of the nearest town.

This telegram must be sent to the address specified in the rules or program by the Race Committee.

Declaration Under Oath

Art. 133. In cases of uncertainty concerning the conditions of the performance, the contestant may be called upon to furnish the additional information necessary to classify him, in the form of a sworn statement, executed before the Contest Committee.

The competitor must give this oath and the official must mention this declaration in detail as well as the reasons that led to it.

Any declaration recognized as false after inquiry by the Contest Committee of the National Federation may lead to disqualification of the competitor.

Optional Measures of Control

Art. 134. The Race Committees are free to impose other measures of control, defining them in the rules.

Supplementary Investigations

Art. 135. The officials will make all the investigations necessary to the establishment of the truth.

Definitions of Starts

Art. 136. CLASS A. (Balloons.) A balloon is considered to have started at the moment when the person whose duty it is to establish such departure begins to see the bottom of the nacelle, if, at that moment, there no longer exists any connection between the aircraft and the ground; thereafter at the moment when this connection is cast off.

CLASS B. (Dirigibles.) A dirigible is considered to have started under the same conditions as stated for aircraft of Class A.

CLASS C. (Airplanes) and D (Gliders.) For aircraft of these two classes there are two kinds of starts:

1. Flying starts;
2. Standing starts.

A flying start is one not effective until the aircraft crosses a starting line in full flight.

An aircraft making its start in full flight is considered as having started when it has completely crossed the starting line.

A standing start is one which is effective at the moment in which the aircraft at rest receives the order of departure from an official.

Regulations Governing Starts

Art. 137. The regulations governing starts must indicate, for all classes, the nature of the start as well as the method of controlling these starts.

Landing

Art. 138. Every voluntary stop is a landing which must be reported on the log by the competitor, with its exact duration.

Involuntary Stops

Art. 139. An involuntary stop must also be considered as a landing and reported as such, except for apparatus of Class A (Balloons) for which an involuntary stop constitutes a landing only if it lasts *longer than fifteen minutes*, but the log must report every stop *no matter what its duration*.

Final Landing

Art. 140. CLASS A. A balloon is considered as stopped when any part of its essential equipment is no longer carried along by it.

The instant of stop is consequently that in which the balloon ceases to advance and not that in which the basket touches the ground.

The moment of stop is determined by the log, by the certificate of witnesses to the descent or to landings and by the control instruments.

If the stop occurs at night or out of sight of any inhabitants, the fact shall be mentioned on the log.

Classes B, C, D, Rounding the Pylons

Classes B (Dirigibles); C (Airplanes), and D (Gliders). In order that an aircraft may be credited with having rounded a pylon, it must have completely traversed the line bisecting the angle of which this pylon is the vertex.

Arrivals

Art. 141. The regulations must state exactly the conditions under which arrivals must take place as well as the conditions under which these arrivals shall, if necessary, be verified and timed.

Measurement of Distances

Art. 142. The distances are measured:

1. Up to 10 kilometers, by actual or surveyed measures, the means employed being those that appear most suitable to the officials;
2. Up to 50 kilometers, either as mentioned in the foregoing paragraph or on an official map with a scale of at least 1/100,000;
3. In excess of 50 kilometers, by the determination by the arc of the earth's circumference, taken at sea level, that unites the verticals of the two points considered.

Highest Speed Record

The speed records shall be run upon a basis established under the control of each National Federation, in accordance with F. A. I. regulations.

**Determining the Distances, Circuit with Pylons,
Closed Circuit**

Art. 143. In the case of a circuit with pylons;

The distances covered shall be determined according to the distances separating the pylons.

However, in the events known as "closed circuit" races, only the *whole courses shall be counted*; no fraction thereof may be used *for Duration or Distance (Records)*. Consequently, the times shall *only be taken at starting (also finishing) line*.

CHAPTER XVII

CLOSURE

Documents

Art. 144. Each meet gives rise to the establishment of a file of documents which must contain all the information necessary to homologation for the granting of the prizes set forth in the rules.

Mention of Records

Art. 145. If records have been established or broken during a meet the documents must mention them. They must also in addition contain the official data necessary to the homologation of these records.

Time Allowed for Transmitting the Files

Art. 146. The files must be transmitted to the Contest Committee of the National Federation:

1. In the case of trials by the Directing Official within 24 hours after concluding the trials;
2. In the case of contests or meets by the Contest Committee within 6 days after the close of the meet.
3. In the case of records, the Directing Official or the contestant, within 6 days from the date of the performance.

Reports

Art. 147. Each meet gives rise to the preparation of a report by the officials and signed by them, which must accompany the documents provided in Article 144.

Preparation of Reports

Art. 148. The report must contain in the following order:

1. The general classification for each event with the award of the prizes.
2. The list of competitors entitled to reimbursement of the entry fee.
3. The list of competitors not entitled to this reimbursement and reasons therefor.
4. The list of penalties inflicted.
5. The list of records made or broken.
6. The list of the protests made by the competitors with a note of the decisions made in consequence thereof and the date of the promulgation of these decisions.

CHAPTER XVIII

HOMOLOGATIONS

Authority of Homologation

Art. 149. The Contest Committees of the Governing Boards pass upon the homologation of the results of the meets whose documents and regular reports are submitted to them within prescribed time.

Delays

Art. 150. This homologation must be announced, within a month after the submission of the files and of the reports.

Promulgations

Art. 151. The homologation of the results of a meet is considered as having been duly communicated to all persons interested when posted at the headquarters of the secretary of the Contest Committee of the National Federation which has pronounced this homologation, or by its publication in the official organ, unless special provisions have been made in a particular set of regulations.

CHAPTER XIX

PRIZES

Delay in the Transmission of Prizes

Art. 152. The total amount of the prizes and awards shall be held at the disposition of the competitors who have made entries, immediately after the expiration of the time within which protests can be made.

Postponement of Transmission of Prizes

Art. 153. Before the payment of prizes or the delivery of rewards, the Race Committee must assure itself that no contestant might be protested.

Deposits in the Case of Appeal to the F. A. I.

Art. 154. Whenever the homologated results of a meet shall have given rise to a protest upon which the Contest Committee of the National Federation shall have been unable to adjudicate as a court of final appeal, the Race Committee will be required, upon the demand of the National Federation of the protestant, to deposit the amount of the prize in a financial institution of good standing.

PART VI

JURISPRUDENCE

Chapter XX

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 Delegation of powers
 Execution of penalties.
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Chapter XXI

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CHAPTER XX

PENALTIES

Powers

Art. 155. All infractions of the F. A. I. regulations, or of the regulations adopted by the Contest Committees of the National Federations, or of special regulations approved for any special event, committed by organizers, officials, contestants, pilots, etc., are liable to the penalties prescribed by the F. A. I., or by the National Federation and imposed by the Contest Committees of the National Federation, or of their authorized delegates.

Delegation of Powers

Art. 156. Each Contest Committee is authorized to delegate the right to inflict certain of these penalties in conformity with Articles 4 and 36.

Execution of Penalties

Art. 157. All penalties shall be immediately carried into effect.

Scale of Penalties and Persons Authorized to Inflict Them

Art. 158. Penalties that may be inflicted are: Loss of place, censure, fine, expulsion, suspension, disqualification. Among these, loss of place, censure, fines up to \$100 (500 francs), and exclusion may be inflicted by the Referee.

Cause for Loss of Place

Art. 159. Loss of place may be pronounced against any competitor who, in a race, shall have executed a maneuver in violation of the rules.

Definition of Loss of Place

Art. 160. Loss of place consists in putting the competitor back one or more places.

Extension

Art. 161. Loss of place may moreover bring on the infliction of another penalty.

Contestants' Time in Case of Demotion

Art. 162. *The time of the contestant who has suffered demotion is non-existent.*

Authority to Impose Demotion

Art. 163. Referees are empowered to levy the penalty of demotion.

Censure

Art. 164. Censure is inscribed on the papers of the offender in the archives of the Contest Committee of the National Federation. It may be made public immediately through official channels.

Delegation

Art. 165. Referees have the right to censure.

Fines, Responsibility

Art. 166. Fines may be imposed upon competitors as well as upon pilots, aides and passengers not conforming to the requirements of the regulations or to the injunctions of the officials.

Entrants are responsible for the fines incurred by their pilots, aides, or passengers.

Time In Which Payment Is Due

Art. 167. The total amount of the fine must be sent within forty-eight hours after notice of imposition to the office of the secretary of the Contest Committee of the National Federation, or to the Referee.

Delay

Art. 168. Any delay in the payment of the amount of the fines after expiration of the time fixed in Art. 167, shall result in suspension, at least until these fines are paid.

Delegation

Art. 169. Referees have the right to impose fines up to \$100 (500 francs) for each offense.

How Fines Are Used

Art. 170. The amount of the fines collected in the course of the year must be employed by the National Federation for the creation of prizes.

The National Federations are empowered to delegate the organization and control of these prizes to the Clubs or Societies that are subject to their regulations.

Exclusion

- Art. 171. Exclusion may be inflicted for any grave fault. It prevents the offender from taking any part in an event in respect of which it is declared. It involves in all cases loss of the entry fee which then becomes the property of the Race Committee.

Delegation

Art. 172. Referees have the right to inflict exclusion.

Suspension

Art. 173. Suspension temporarily suppresses the right of the offender to take part in any aeronautic meet held in any country where F. A. I. regulations are in force.

Withdrawal of License; Delay

Art. 174. Every licensed contestant under suspension must forward his license to the office of the Contest Committee Secretary as soon as notification of the decision is given. The delay in the transmission of this document shall be added to the original duration of the penalty.

Entries Made By Suspended Party

Art. 175. Suspension involves the annulment of entries engaged previously, for events that were to take place during the period of this suspension.

It likewise involves loss of the entry fees for these events.

Disqualification

Art. 176. Disqualification definitely extinguishes the offender's right to take part in any aeronautic meet.

It has, as a consequence, the annulment of the entries contracted before, with the loss of the entry fees.

The list of suspended or disqualified competitors is communicated by the Contest Committees of the National Federation to the Secretary of the F. A. I., who must transmit it by letter to all National Federations.

Loss of Rights By Disqualified Persons

Art. 177. Any competitor disqualified in a meet will lose all right to receive any of the prizes awarded during the stated meet.

CHAPTER XXI

APPEALS

Rights of Appeal; Jurisdictions

Art. 178. Contestants have the right of appeal:

1. From officials' decisions, before the sections of first instance;
2. From decisions of first instance, before the Contest Committee of the National Federation, all sections assembled.

The officials concerned may not sit in the courts of appeal.

Time Allowed for Appeal

Art. 179. The right of appeal provided for in the above article expires two weeks after the date of the notification of the decision. Every appeal must be accompanied by the sum of twenty dollars which amount shall be refunded only if the grounds of the appeal are duly recognized.

National Jurisdictions

Art. 180. The Contest Committees of the National Federations decide as courts of last resort in the case of appeals formulated by their nationals or naturalized citizens.

Summoning of Interested Parties

Art. 181. The Contest Committees of the National Federations can decide in cases of appeal only after having duly summoned and heard the parties concerned, provided the latter appear at the date and hour named by the summons.

Respite

Art. 182. The Contest Committees of the National Federation, as also the sections of first instance, have the right to grant a respite or reprieve for offenses committed for the first time. When the respite is ordered, the penalty shall not be applied, but it shall be reinstated and increased with a fresh penalty if the party benefiting by such reprieve should happen to be punished anew within the period of one year. After the lapse of one year from the day on which the reprieve has been ordered, the penalty shall suffer permanent annulment if the party in question has not incurred any disciplinary measure in any Federation.

International Jurisdiction

Art. 183. The conference of the F. A. I. constitutes the international court of appeal; it decides as a court of last resort.

Right of Appeal to the F. A. I.

Art. 184. The National Federation of a country holding membership in the F. A. I. can alone file an appeal before the conference of the F. A. I., from the decisions of a Club of another country, as far as its nationals are concerned. The Federation is the judge of whether such appeal is opportune.

Definition of Right of Appeal

Art. 185. The appeal can be introduced before the F. A. I. conference only if a Contest Committee renders a decision concerning a contestant who belongs to a country foreign to the National Federation that exercised control over the aeronautic event.

Time Allowed for Appeal

Art. 186. This right of appeal expires one month after notification of the decision against which such appeal is taken, barring delays in the mail.

Where Appeal Is To Be Sent

Art. 187. The appeal must be addressed to the Secretary of the F. A. I. and notice thereof must be dispatched by the same mail to the Contest Committee of the National Federation that rendered the decision.

PART VII

RECORDS

Chapter XXII

ART. 188 to 200

{
Definition.
Title of records.
Obligations of control.
Publications pertaining to records
Cognizance of records.
Homologation.
Definition of national records.
Publication of national records.
Formalities of homologations.
Exactness of records.
Crediting of records.
Homologation of records.
Jurisprudence.

ART. 201 to 203

{
A. C. A. Rules.

CHAPTER XXII

RECORDS

Definition

Art. 188. The record is the maximum result obtained at the time in question, by any given aviator and aircraft within the conditions defined by the F. A. I.

Title of Records

Art. 189. The records belong personally to the aviator of the aircraft and shall be recorded both with the name of the aviator and the name of the type of aircraft with which the record was made.

Obligations of Control

Art. 190. In order to establish validly the record, the aviator must provide himself with the services of the officials necessary to exercise control over his performance.

He must also carry all the instruments or control apparatus which the official requires.

The above is wholly his responsibility.

Publications Pertaining to Records

Art. 191. The F. A. I. shall publish annually:

1. The list of records the homologation of which the F. A. I. authorizes;
2. The conditions under which records must be established and controlled;
3. The list of world records.

Records that have ceased to be recognized by the F. A. I. must no longer be published, either as "National Records" or "World Records."

Cognizance of Records

Art. 192. The Contest Committee of the National Federation alone are qualified to take cognizance of records established or broken in their respective countries, for aircraft of classes A, B, C, D, and E.

In the event that the record involves traversing the territory of several Federations, the Contest Committee of the territory of the start is the one qualified to take cognizance thereof.

Homologation

Art. 193. Contest Committees may homologate only the records admitted by the Federation Aeronautique Internationale, established or broken within the conditions specified by the latter body.

Definition of National Records

Art. 194. The national record is the one established or broken upon the territory of the National Federation in question (country of start), no matter what may be the nationality of the aviator. No record may be homologated outside of the countries represented in the F. A. I.

No record may be homologated if it has not been controlled.

Publication of National Records

Art. 195. The Contest Committees of the National Federations publish periodically (yearly, in any case), not later than December 31st, the list of National records, and communicate it in due time to the F. A. I. for the determination of world records. The office of Secretary of the F. A. I. is authorized to ask for supplementary information and to postpone the homologation of the world record until the next conference.

Formalities of Homologations

Art. 196. In the case of records established during an aeronautic meet, the request for homologation must be visé by an official.

For homologation of records established at other times, the request must be accompanied by documents and attestations of a character to provide exact and authentic data.

For records in connection with which distance is a factor, the request for homologation must always be accompanied by an Official Report of measurement drawn up under the responsibility of the National Federation.

Exactness of Records

Art. 197. No record may be homologated on the basis of figures that has been established by deduction. For example: a time measurement may be homologated only if it has actually been taken by the stop-watch or chronometer.

Crediting of Records

Art. 198. A record established by an aircraft carrying a certain number of passengers or a certain useful load is broken, in its category, when an aircraft carrying an equal or greater number of passengers, or an equal, or greater load makes a performance showing better results in distance, duration, speed or altitude, according to the nature of the record.

All records thus broken shall be credited to the new holder of the title.

Homologation of Records

Art. 199. The Contest Committees of the National Federations are obliged to homologate records only upon request of the contestants, in compliance with the regulations.

Jurisprudence

Art. 200. Records are subject to the same jurisdiction and the same jurisprudence as contests, as far as protests and appeals are concerned.

ADDITIONAL RULES ADOPTED BY THE CONTEST COMMITTEE OF THE AERO CLUB OF AMERICA APPLICABLE TO SANCTIONED EVENTS HELD IN ITS TERRITORY

Minimum Number of Entries

201. In addition to fixing the maximum number of contestants in any event (F. A. I. Rules, Article 110), the Race Committee may set a minimum number of contestants, reserving the option to cancel the event if the required number of entries have not been received on the date when the entries close. However, should the minimum or more than the minimum number of entries be received and accepted by the Race Committee for any event, this event must be held although the number of contestants who appear at the starting line are less than the minimum number of entries required.

Contestant's Penalties for Failure To Start

202. Any contestant either entrant or aviator whose entry in any event has been acceptable by the Contest Committee, who fails or refuses to start without giving in writing reasons or explanations acceptable to the Contest Committee is liable to any of the penalties prescribed by the F. A. I. Rules in Articles a-18, 155, 156, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177.

Weight Equivalent of Passenger

203. The minimum weight of passengers carried in aeronautic contests is fixed (according to U. S. Government test requirements) at 180 lbs. Ballast may be carried to bring the weight of any passenger up to 180 lbs., but must be secured on or directly under *that passenger's seat*; 180 lbs. so placed may be carried in lieu *of each passenger*. (For records of useful loads, see F. A. I. *Record Trials*, Appendix 5.)

Appendix No. 1

SPHERICAL BALLOONS

Volume of Balloon V	Limits of Volume for F. A. I. Rating Tolerance $\pm 5\%$	Diameter of Balloon $D = \sqrt[3]{\frac{6V}{\pi}}$	Diameter of Balloon $D = \sqrt[3]{\frac{6V}{\pi}}$	Circumference of Balloon $C = \pi D$	Circumference of Balloon $C = \pi D$
cu. meters	cu. meters	meters	meters	meters	meters
100		5.759		18.092	
150		6.592		20.710	
200		7.257		22.797	
250		7.816		24.554	
300		8.306		26.093	
350		8.744		27.469	
400		9.142		28.719	
450		9.508		29.869	
500		9.847		30.937	
600	570		10.297		32.349
	630	10.465		32.875	
700		11.016	10.635	34.608	33.411
800		11.518		36.184	
	855		11.776		36.995
900		11.979		37.633	
	945		12.175		38.249
1.000		12.407		38.978	
	1.140		12.952		40.690
1.200		13.184		41.420	
	1.260		13.401		42.100
1.400		13.880		43.604	
	1.520		14.265		44.814
1.600		14.511		45.589	
	1.680		14.759		46.366
1.800		15.092		47.414	
2.000		15.632		49.109	
	2.090		15.863		49.385
2.200		16.136		50.693	
	2.310		16.401		51.525
2.500		16.839		52.901	
	2.850		17.590		55.261
3.000		17.894		56.216	
	3.150		18.183		57.124
3.500		18.838		59.180	
	3.800		19.343		60.770
4.000		19.695		61.873	
	4.200		20.018		62.889
4.500		20.484		64.351	
5.000		21.216		66.651	

Appendix No. 2 **FACSIMILE OF THE ANNUAL LICENSE OF THE F. A. I.**

<p>Fédération Aéronautique Internationale</p> <p>— ■ —</p> <p>United States of America</p> <p>— ■ —</p> <p>Aero Club of America Annual License</p>
--

<p>Fédération Aéronautique Internationale</p> <p>— ■ —</p> <p>United States of America</p> <p>— ■ —</p> <p>LICENSE ISSUED TO</p> <p>Mr.</p> <p>Place of birth.....</p> <p>Date of birth.....</p> <p>Contest Committee</p> <p>..... Secretary</p>	<p>Photograph of Licensee</p> <p>Year of 192</p> <p>No. of Brevet.....</p> <p>Origin of Brevet.....</p> <p>Nature of Brevet.....</p> <p>Signature of Licensee</p> <p>License No.</p> <p>Valid until December 31st of the year of issuance</p>
--	--

Appendix No. 3 (a)

Number.....

Course..... Place..... Date.....

Organized by

Event

Ascension Record

Full name of pilot.....

Number of license.....

Name and age {
 of {
 Passengers {

Date of flight.....

Place of departure

Time of departure.....

Class of aircraft.....

Description of aircraft (type, make, etc.)

Motor..... H. P..... No.....

List of instruments (barograph, make, graduation, number, cylinder duration, if sealed and how, etc., etc.).....

Kind of gas..... Specific gravity.....

Ascensional force..... (lb. per 1000 cu. ft.).....lbs. } Class

Total ascensional force.....lbs. } A & B

Weight of aideslbs.

Weight of passengerslbs.

Weight of instrumentslbs.

Weight of supplies and equipment.....lbs.

Weight of ballast disposablelbs.

Total weightlbs. } Class

Remaining ascensional forcelbs. } A & B

Barometer reading on ground at time of departure.....

Ground temperature at time of departure °F.....

Wind direction..... Velocity.....

Appendix No. 3 (c)**REPORT OF FINAL LANDING**

Date of landing.....
 Time of landing by pilot's watch.....
 By official time of place of landing.....
 Elapsed time
 Conditions of landing {
 (Valve or Rip) {
 Place of landing.....
 Longitude (from Greenwich Meridian).....
 Latitude
 Name of locality.....
 Names and distances from three towns or from three prominent
 geographical points, nearest to place of landing.....
 Make, type and characteristics of the aircraft.....
 Motor H. P. No.
 Instruments (make, type, etc.); (barograph, cylinder duration, if
 sealed and how).....

 Pilot; name in full.....
 Passengers, names in full (or weight of ballast if used in place of pas-
 sengers)

 Barometric pressure at the ground.....
 Temperature °F at the ground.....
 Wind direction..... Velocity.....
 I hereby certify that the above statements are true.
 Date.....

(Pilot's signature)

The aides and passengers traveling on board the balloon controlled
 by Mr.....certify that the declara-
 tions stated above are correct in whatever concerns the ascension
 of the

Signatures of Witnesses {

*(Witnesses should give full names, titles, rank, employer, profession,
 addresses, etc.)*

Appendix No. 4

LANDING CERTIFICATE

Nature of test.....
 Longitude (from Greenwich Meridian).....
 Latitude
 Name of locality.....
 Names and distances from three towns or from three prominent
 Geographical points, nearest to place of landing.....

 Time of landing, by pilot's watch.....
 By official time of place of landing.....
 Date and day of landing.....
 Pilot's name in full.....
 Names, weight & age {
 of {
 Passengers {
 Description of aircraft.....
 Motor..... H. P..... No.....
 Instruments (make, type, etc.); (barograph, cylinder duration, if sealed
 and how)

In order to establish the correctness of the flight, the Aero Club of America requests the witnesses of the landing to attach their signatures hereto and if possible, have them attested by a municipal magistrate or agent of the authorities or of a railway.

Signatures of {
 Witnesses {
 (Names in full, {
 title, rank, em- {
 ployer, profession, {
 addresses, etc.) {

(Signature of Pilot)

Signature and seal of municipal magistrate or agent of the authorities or of a railway.

Signatures of {
 engers {

ADDITIONAL RULES COVERING AERONAUTIC RECORDS RECOGNIZED BY F. A. I.

1920

Appendix No. 5

Remarks on Record Trials

Only the performances of aircraft described in the following Appendix of the F. A. I. Rules have been considered by the F. A. I. worthy of recognition as World's Records, and no other performances may be called World's Records. The description of these performances is sufficiently clear, but the method of conducting them has been left to the officials, who must, of course, be thoroughly familiar with all the F. A. I. Rules.

However as World's Records are only ratified once a year (Art. A-26) by the F. A. I. and as any irregularity in the reports of any trial may result in the rejection of the record, anyone attempting a record should read all the rules for their own protection.

Application for record trials should be made well in advance, to secure the services of the timers, and to obtain the necessary instruments.

Instruments for Altitude Trials

Barographs. As barographs are not infallible, two should be carried when possible.

Few barographs record according to the printed scale on the chart, therefore a calibration should be made before the attempt for altitude, which will permit quite an accurate reading of the actual altitude immediately after the flight. The official altitude can only be determined after the calibration of the barograph with the chart of the flight (see page 167 for description of determining altitude table) which may require some days.

To insure satisfactory functioning of the barograph it should be suspended on elastic bands fastened above and below. This will prevent vibration from shaking the ink from the pen, or injury to the clock.

The barograph must be sealed by the officials before the flight, and returned to the officials after the flight with the seals intact. Only the official in charge may break the seals, should this be necessary to read the chart, otherwise the barograph should be returned for calibration with the seals intact.

Endurance Trials

Endurance records are only recognized when the aircraft (balloons excepted) returns to the point of departure, at which place the

timers are stationed. Recording barographs, preferably with 24-hour charts, must be carried, and an additional check on the barographs, may be had if the pilot is required to fly over a definite course in order that the aircraft may be regularly seen by the officials in daylight and heard at night.

Speed Trials (Class C)

Trials for maximum speed over mile or kilometer straightaway courses are clearly described on pages 158 and 160. However, one kilometer is the only straightaway distance recognized by the F. A. I. for maximum speed trials.

Trials for speed over the other recognized distances (100, 200 kilometers, etc.) must take place over a closed course, returning to the point of departure, at which place the time is taken (Art. 143). The course, however, need not be the full distance, for example, all the above records could be made over a 25, or 50 kilometer course.

WORLD'S RECORDS OFFICIALLY RECOGNIZED BY THE F. A. I., JANUARY 1, 1922

(F. A. I. Statutes, Art. a-26)

Class A (Free Balloons)

- No. 1. DURATION: H. Kaulen (Dec. 13-17, 1913) 87 hours.
- No. 2. DISTANCE: Berliner (Feb. 8-10, 1914) 3052 kilometers, 700 meters. 1896.86 miles.)
- No. 3. ALTITUDE: Suripg & Berson (June 31, 1901) 10,800 meters. (35,434.8 feet.

Class B—Dirigibles (Airships)

- No. 1. DURATION: Castracane & Castruccio (June 25, 1913) 15 hours.
- No. 2. DISTANCE: Castracane & Castruccio (July 30, 1913) 810 kilometers. (493.31 miles.)
- No. 3. ALTITUDE: Cohen (June 18, 1912) 3080 meters. (10,105.5 feet.)
- No. 4. MAXIMUM SPEED: Castracane & Castruccio (July 30, 1913) 64 kilometers, 800 meters per hour. (40.26 miles per hour.)

Class C—Aircrafts

- No. 1. DURATION: Ed. Stinson & Lloyd Bertaud at Roosevelt Field (Dec. 30, 1921) J. L. 6 monoplane, 26 hrs., 19 min., 35 sec.
- No. 2. DISTANCE: L. Boussoutrot and Jean Bernard, over the course from Villesauvage to La Marmogne. (June 3-4, 1920), Goliath-Farman airplane with two 260 H. P. Salmson motors.
- No. 3. ALTITUDE: Lieut. MacReady at Dayton, Ohio (Sept. 28, 1921). Le-pere biplane, Liberty motor, 400 H. P., 10,518 meters. (34,509.5 feet.)
- No. 4 (a). SPEED FOR THE FOLLOWING RECOGNIZED DISTANCES:
100 kilometers (62.137 miles). Brack Papa at Villesauvage (Oct. 1, 1921). Fiat airplane with 700 H. P. Fiat motor, 20 min., 5 2/5 sec.
200 kilometers (124.274 miles). Georges Kirsch, at Villesauvage (Oct. 1, 1921). Nieuport Delage airplane, 300 H. P. Hispano-Suiza motor, 42 min., 39 4/5 sec.
500 kilometers (310.685 miles). No record.
1000 kilometers (621.37 miles). Lucien Boussoutrot and Jean Bernard, over the course from Villesauvage to La Marmogne (June 3-4, 1920). Goliath-Farman airplane with two 260 H. P. Salmson motors, 10 hrs., 19 min., 46 sec.

1500 kilometers (745.64 miles). Lucien Boussoutrot and Jean Bernard, over the course from Villesauvage to La Marmogne (June 3-4, 1920). Goliath-Farman airplane with two 260 H. P. Salmson motors, 16 hrs., 42 min., 8 sec.

2000 kilometers (1242.74 miles). No record.

No. 4 (b). MAXIMUM STRAIGHTAWAY SPEED:

Sadi Lecoq at Villesauvage (Sept. 26, 1921). Nieuport-Delage airplane, 300 H. P. Hispano-Suiza motor; 330 kilometers, 275 meters per hour. (205.22 miles per hour.)

No. 5. RECORDS CARRYING USEFUL LOAD:

Duration: Useful load carried, 1500 kilos (3,306.9 lbs.). Captain C. T. R. Hill at Cricklewood, England (June 4, 1920), Handley Page (W-8) airplane with two 450 H. P. Napier Lion motors, 1 hr., 20 min.

Distance: No record.

Altitude: Useful load carried, 250 kilos (551.1 lbs.). Jean Le Boucher at Bourget (July 6, 1921), Breguet Rateau airplane, 280 H. P. Renault motor, 6,782 meters (22,251.7 feet).

Altitude: Useful load carried, 1,500 kilos (3,306.9 lbs.). Captain C. T. R. Hill at Cricklewood, England (May 4, 1920), Handley Page (W-8) airplane with two 450 H. P. Napier Lion motors, 4,267 meters (14,000 feet).

RECORDS RECOGNIZED BY THE INTERNATIONAL AERONAUTIC FEDERATION

January 1, 1920

Class A (Free Balloons)

No. 1. DURATION (without landing).

No. 2. DISTANCE (without landing).

No. 3. ALTITUDE (instructions, see pages 160-167).

Class B (Dirigibles)

No. 1. DURATION (returning to point of departure without landing).

No. 2. DISTANCE (returning to point of departure without landing).

The distance shall be determined by the length of the arc of the earth's circumference—taken at sea level—that unites the vertical at the point of departure with that at the point of arrival.

(Observations shall be made according to Article 125 and the general regulations.)

No. 3. ALTITUDE (returning to point of departure without landing) (instructions, see pages 160-167).

No. 4. SPEED (straight course).

(1) (To obtain straightaway speed) the course must be flown twice in each direction [permitting the times to be taken according to Par. (4), for the average Par. (3)] in one continuous flight (without landing) which must be practically horizontal.

(2) Not more than 30 minutes may lapse from the time the aircraft leaves until it re-enters the same control at either end of the course.

(3) The greatest speed is determined as the average of the speeds in miles per hour without any correction.

(4) The times must be taken in conformity with the stipulations of the plan of the course (Sketch A, page 161).

(5) Existing speed records can only be beaten by the minimum difference of 4 km. (2.485 miles) per hour.

Class C (Airplanes)

Seaplane or Flying Boat records will be recognized and recorded as such after January 1, 1922.*

No. 1. DURATION (returning to point of departure without landing).

No. 2. DISTANCE (returning to point of departure without landing).

The distance shall be determined by the length of the arc of the earth's circumference—taken at sea level—that unites the vertical at the point of departure with that at the point of arrival.

(Observations shall be made according to Article 125 and the general regulations.)

No. 3. ALTITUDE (returning to point of departure without landing) (instructions, see pages 160-167).

No. 4. SPEED RECORDS.

(a) Speeds over recognized distances.

The greatest speed returning to the point of departure, over a distance of: (Art. 142)

100 kilometers = 62.137 miles.

200 kilometers = 124.274 miles.

500 kilometers = 310.685 miles.

1000 kilometers = 621.37 miles.

and each additional 500 kilometers (310.685 miles).

(b) MAXIMUM SPEED.

1. The maximum speed is timed over a straight course of one kilometer (Art. 142). During each attempt the contestant must fly over the course twice in each direction, permitting the times to be taken in accordance with Par. (3) in one continuous flight (without landing), and at a maximum altitude of 50 meters (164 ft.). The airplane must be within this altitude (164 ft.) at a point 500 meters (1640.4 ft.) (See plan of course) before entering into either end of the course. The greatest speed is determined as the average of the speeds in miles per hour without any correction.

2. Existing speed records can only be beaten by the minimum difference of 4 km. (2.485 miles) per hour.

*Prior to January 1st, 1922, there was no differentiation between Airplanes and Seaplanes or Flying Boats for World's Records in Class C Airplanes.

3. The times must be taken in conformity with the stipulations of the plan of the course (Sketch A, page 161).

No. 5. RECORDS OF USEFUL LOAD CARRIED.

Records of useful load carried are recognized for

1. DURATION;

2. DISTANCE;

3. ALTITUDE (instructions, see pages 160-167).

In the following amounts of useful load carried, over and above aviator's weight:

250 kilograms = 551.15 lbs.

500 kilograms = 1102.31 lbs.

1000 kilograms = 2204.62 lbs.

1500 kilograms = 3306.93 lbs.

2000 kilograms = 4409.244 lbs.

And each additional 1000 kilograms (2204.62 lbs.).

Class D (Gliders)

No. 1. DURATION (without landing).

No. 2. DISTANCE (without landing).

No. 3. ALTITUDE (above that of the point of departure) (instructions, see pages 160-167).

No. 4. SPEED RECORDS.

(a) Speeds over recognized distances.

The greatest speed returning to the point of departure over a distance of:

50 meters = 164 ft.

100 meters = 328.08 ft.

And each 100 meters up to 1 kilometer and each kilometer (.62137 mile) thereafter.

(b) MAXIMUM SPEED.

The maximum speed shall be obtained by flying around a closed circuit (no restrictions on length of circuit).

Class E (Kites)

No. 3. ALTITUDE (above point of departure).

(a) For "unmanned" apparatus.

(b) For "manned" apparatus.

MEASUREMENTS OF CONTROLS FOR ESTABLISHING ALTITUDE RECORDS

Classes A—Balloons

Classes B—Dirigibles (Airships)

Classes C—Airplanes

The altitude attained shall be determined by converting the depression of the barometer into altitude by the use of the standard F. A. I. Conversion Table for barometric pressure and altitude (see page 167). This method is obligatory for all countries affiliated with the F. A. I.

The depression of barometer or barograph shall be checked under a bell jar at an official laboratory, this calibration to be under the responsibility of the National Federation. A certificate of this calibration should be attached to the other official papers.

The point of departure of the flight shall be assumed as corresponding to a pressure of 760 millimeters of mercury (29.90 inches).

The altitude allowed the competitor shall be that obtained from the Standard F. A. I. Conversion Table regardless of what the altitude at the point of departure may be or whatever the pressure at this point may have been during the test.

The existing altitude record can only be beaten by the minimum difference of 100 meters (328.1 feet).

NOTES ON REQUIREMENTS

SPEED TRIALS, MILE OR KILOMETER COURSE

Timer's Sights

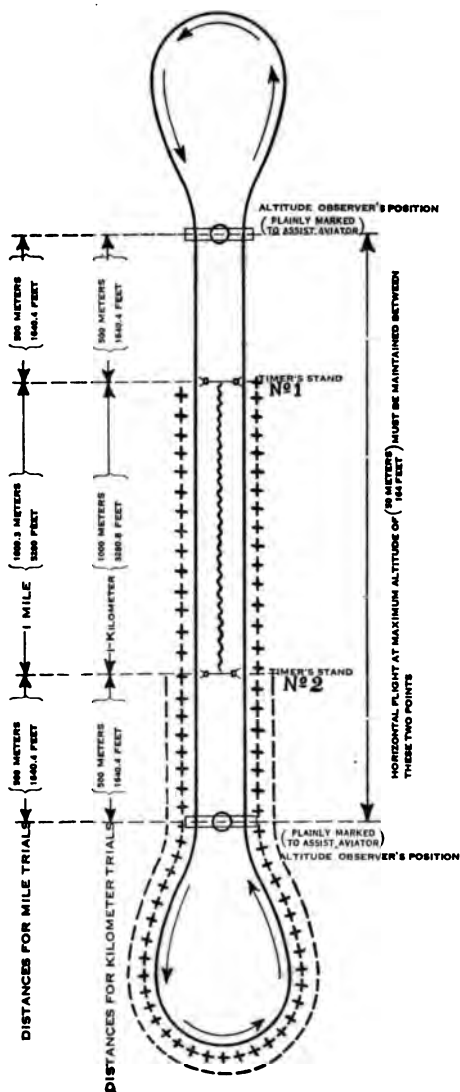
Sighting wires establishing a perpendicular plane through the sky (see Sketch B) should be erected at both ends of the mile or kilometer course, the Timer taking his position directly beneath the sighting wires—the time of the airplane being taken when it crosses above the two wires.

Communication

Telephone communication between the two Timers' stands is almost essential and signals of protest should be arranged between observers at the 500 meter stations and the Timers, if the telephone communication does not include them.

The Timer should have a sheet or large flag and arrange a code of *signals with the pilot* in order that the latter may know that his *trials have been successfully* carried out before returning to the *airdrome, which may be some miles distant.*

EXPLANATORY DIAGRAM OF MILE OR KILOMETER TIME TRIALS



Sketch A

COURSE OF AIRPLANE

ELECTRICALLY TIMED IS THE PORTION OF FLIGHT OF AIRPLANE TIMED BY BOTH STATIONS, GIVING THE TIMES OF FOUR PASSAGES THE AVERAGE OF WHICH FIGURED IN MILES PER HOUR

1.

2.

PORTION OF FLIGHT OF AIRPLANE TIMED AT

PORTION OF FLIGHT OF

SUBTRACTING THE

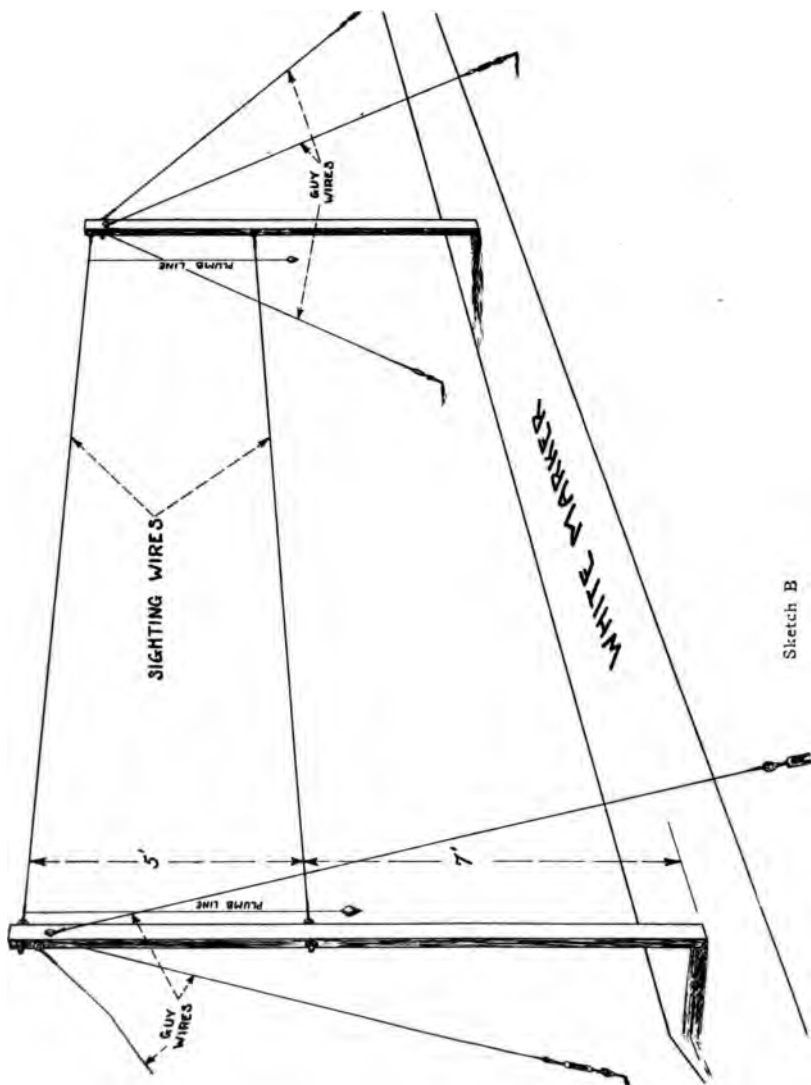
TIME FOR A DOUBLE PASSAGE OVER THE MILE OR KILOMETER STRAIGHTAWAY

FROM THE TIME OF STAND NO 1 FOR ++++ GIVES THE AVERAGE

ELECTRIC TIMING

NOT USED

TIMER'S SIGHTS FOR MILE OR KILOMETER COURSE



A. C. A. Timers' Sheet

(Electric Timing)

Maximum Speed (Straightaway Course)

.....
 Place Date
 Airplane
 Motor
 Pilot

First Attempt

Time (of day)

Direction (compass).....of first flight, time.....miles per hour.....
 Direction (compass).....of second flight, time.....miles per hour.....
 Direction (compass).....of third flight, time.....miles per hour.....
 Direction (compass).....of fourth flight, time.....miles per hour.....

The total of miles per hour divided by 4 gives MAXIMUM SPEED
 in miles per hour.

.....
 Place Date
 Airplane
 Motor
 Pilot

Second Attempt

Time (of day)

Direction (compass).....of first flight, time.....miles per hour.....
 Direction (compass).....of second flight, time.....miles per hour.....
 Direction (compass).....of third flight, time.....miles per hour.....
 Direction (compass).....of fourth flight, time.....miles per hour.....

The total of miles per hour divided by 4 gives MAXIMUM SPEED
 in miles per hour.

(Signed).....
 Timer

A. C. A. Timers' Sheet

(Using Stop Watch)

Maximum Speed (Straightaway Course)

Place	Date
Airplane	
Motor	
Pilot	

First Attempt

(Refer to diagram, page 161) Time (of day).....

Time for 2 passages and loop taken at Stand No. 1.....

Time for loop between passages taken at Stand No. 2.....

Substraction gives average time for 2 trips over course.....=.....m.p.h.

Time for 2 passages and loop taken at Stand No. 1.....

Time for loop between passages taken at Stand No. 2.....

Substraction gives average time for 2 trips over course.....=.....m.p.h.

Addition gives Maximum Speed in m. p. h. (The average of four trips over the course)

Signed.....

Timers

Measurement of Course

Signed.....

Official's Report

This airplane made all flights in.....attempts, according to the F. A. I. Rules.

Directing Official

Remarks:

Names of Assistant Officials.....

.....

.....

.....

.....

SECTION FOUR

Part 1

Addenda to the General Rules and Regulations

(Including)

F. A. I.

Conversion Table

of

Barometric Pressure to Altitude

CHAPTER I

STANDARD ALTITUDE

For Convenient Reference Only

NOTE: Official figures to be obtained from F. A. I. regulation conversion table for barometric pressure and altitude, which is given in millimeters of mercury and meters altitude. See page 167.

(1) Aneroid Reading (ft.)	(2) True Height (ft.)	(3) Inches of Mercury	(4) Relative Pressure p	(5) Relative Density °	(6) Temperature °C	(7) Absolute Temperature °C
0	0	29.90	1.000	1.025	9	282
1,000	1,000	28.82	.964	.994	7.5	280.5
2,000	1,990	27.78	.929	.962	6	279.
3,000	2,980	26.77	.895	.933	4.5	277.5
4,000	3,960	25.80	.863	.904	3	276.
5,000	4,940	24.85	.832	.876	+1.5	274.5
6,000	5,900	23.98	.802	.849	0	273
7,000	6,870	23.12	.773	.822	-1.5	271.5
8,000	7,830	22.29	.745	.796	-3	270
9,000	8,780	21.47	.718	.771	-4	269
10,000	9,730	20.69	.692	.747	-5.5	267.5
11,000	10,670	19.95	.667	.724	-7.5	263.5
12,000	11,600	19.21	.643	.703	-9	264
13,000	12,520	18.55	.620	.683	-11	262
14,000	13,440	17.85	.597	.663	-13	260
15,000	14,360	17.23	.576	.644	-14.5	258.5
16,000	15,270	16.60	.555	.626	-16.5	256.5
17,000	16,180	15.99	.535	.607	-18.5	254.5
18,000	17,090	15.42	.516	.589	-20	253
19,000	18,000	14.84	.497	.571	-22	251
20,000	18,880	14.35	.480	.554	-24	249
21,000	19,760	13.81	.462	.537	-25.5	247.5
22,000	20,650	13.30	.445	.521	-27	246
23,000	21,520	12.82	.429	.506	-29	244
24,000	22,380	12.37	.414	.491	-30.5	242.5
25,000	23,240	11.84	.399	.477	-32	241
26,000	24,110	11.48	.384	.462	-33.5	239.5
27,000	24,960	11.06	.370	.448	-35	238
28,000	25,800	10.66	.357	.435	-36.5	236.5
29,000	26,650	10.28	.344	.422	-38	235
30,000	27,480	9.92	.332	.410	-39.5	233.5

CHAPTER II

F. A. I. CONVERSION TABLE FROM BAROMETRIC PRESSURE (in Millimeters of Mercury) to ALTITUDE (in Meters)

According to the decision made by the Conference at Brussels in October, 1919, altitude records after January, 1920, in all countries affiliated with the F. A. I., shall be determined by the use of the following table, calculated from the formula:

$$Z = 5 \left(3064 + 1.73P - 0.0011P^2 \right) \log \frac{760}{P} \text{ in which}$$

Z = Altitude in meters.

P = Millimeters of mercury.

Established for this occasion by Mr. Rudolphe Soreau based on average observations made with pilot balloons in different countries. This formula defines the standard atmosphere (see *Aerophile* of November, 1919, and *Comptes rendus de l'Academie des Sciences* de Decembre 1919).

This table shall be used as follows:

The barometer or barograph shall be tested under a bell jar. According to these regulations, P the minimum value of the air pressure, shall be taken from the official reading of the above test, and shall be expressed in millimeters of mercury, without decimals. The altitude Z corresponding to this value of the pressure will be found in the table and is the official altitude.

NOTE: For convenient reference table in inches of mercury and altitude in feet, see page 166.

NOTE: To convert millimeters into inches multiply by .03937; to convert inches into millimeters multiply by 25.4; to convert meters into feet multiply by 3.28083; to convert feet into meters multiply by .3048.

NOTE: Δz is difference in meters, between each pressure reading or each millimeter of mercury.

P	Z	Δz	P	Z	Δz	P	Z	Δz
40	20.022	158	1	475	123	2	235	101
1	19.864	153	2	352	121	3	134	100
2	711	150	3	231	119	4	034	98
3	561	147	4	112	117	5	16.936	97
4	414	143	5	17.995	114	6	839	95
5	271	140	6	881	112	7	744	94
6	131	137	7	769	111	8	650	93
7	18.994	134	8	658	108	9	557	91
8	860	131	9	550	107			
9	729	128				70	16.466	
			60	443	105	1	376	80
50	601	126	1	338	103	2	288	81

P	Z	Δz	P	Z	Δz	P	Z	Δz
3	201	87	7	211	54	160	11.208	40
4	114	85	8	157	54	1	168	40
5	029	83	9	103	53	2	128	40
6	15.946	83				3	088	39
7	863	82	120	050	53	4	049	39
8	781	80	1	12.997	53	5	010	39
9	701	80	2	944	52	6	10.971	39
			3	892	51	7	932	39
80	621	79	4	841	51	8	893	38
1	542	77	5	790	51	9	855	38
2	465	77	6	739	50			
3	388	76	7	689	50	170	817	38
4	312	75	8	639	50	1	779	38
5	237	74	9	589	49	2	741	38
6	163	73				3	703	37
7	090	73	130	12.540	49	4	666	37
8	017	71	1	491	49	5	629	37
9	14.946	71	2	442	48	6	592	37
			3	394	48	7	555	37
90	875	70	4	346	48	8	518	36
1	805	69	5	298	48	9	482	36
2	736	68	6	251	47			
3	668	68	7	204	47	180	446	36
4	600	67	8	158	46	1	410	36
5	533	67	9	112	46	2	374	36
6	466	66				3	338	36
7	400	65	140	066	46	4	302	35
8	335	64	1	020	45	5	267	35
9	271	63	2	11.975	45	6	232	35
			3	930	45	7	197	35
100	14.208	63	4	885	44	8	162	35
1	145	63	5	841	44	9	127	34
2	082	62	6	797	44			
3	020	61	7	753	43	190	10.093	34
4	13.959	61	8	710	43	1	059	34
5	898	60	9	667	43	2	025	34
6	838	60				3	9.991	34
7	778	59	150	624	43	4	957	33
8	719	58	1	581	43	5	924	34
9	661	58	2	538	42	6	890	33
			3	496	42	7	857	33
			4	454	41	8	824	33
110	603	58	5	413	42	9	791	33
1	545	57	6	371	41			
2	488	56	7	330	41	200	758	33
3	432	56	8	289	41	1	725	33
4	376	56	9	248	40	2	692	32
5	320	55				3	660	32
6	265	54						

F. A. I. CONVERSION TABLE

P	Z	Δz	P	Z	Δz	P
4	628	32	8	330	27	1
5	596	32	9	303	27	2
6	564	32				3
7	532	32	250	8.276	27	4
8	500	32	1	249	27	5
9	468	32	2	222	27	6
		31	3	195	27	7
210	437	31	4	169	26	8
1	406	32	5	142	27	9
2	374	31	6	116	26	
3	343	31	7	089	27	300
4	312	31	8	063	26	1
5	282	30	9	037	26	2
6	251	31			26	3
7	220	31	260	011		4
8	190	30	1	7.985	26	5
9	160	30	2	959	26	6
		31	3	933	26	7
220	9.129	30	4	907	26	8
1	099	30	5	882	25	9
2	069	30	6	856	26	
3	039	30	7	831	25	310
4	009	30	8	806	25	1
5	8.980	29	9	780	26	2
6	951	29			25	3
7	922	29	270	755		4
8	893	29	1	730	25	5
9	864	29	2	705	25	6
		30	3	680	25	7
230	834	29	4	655	25	8
1	805	29	5	630	25	9
2	776	29	6	605	25	
3	747	29	7	580	25	320
4	718	29	8	556	24	1
5	690	28	9	531	25	2
6	662	28			24	3
7	634	28	280	7.507		4
8	606	28	1	483	24	5
9	578	28	2	458	25	6
			3	434	24	7
240	550	28	4	410	24	8
1	522	28	5	386	24	9
2	494	28	6	362	24	
3	466	28	7	338	24	330
4	438	28	8	314	24	1
5	411	27	9	290	24	2
6	384	27			24	3
7	357	27	290	266		4
		27			24	

P	Z	Δz	P	Z	Δz	P	Z	Δz
5	262	21	9	381	19	2	597	18
6	241	21				3	579	17
7	220	21	380	362	19	4	562	18
8	199	21	1	343	19	5	544	17
9	178	21	2	324	19	6	527	17
			3	305	19	7	510	18
340	6.157	21	4	286	18	8	492	17
1	136	21	5	268	19	9	475	17
2	115	20	6	249	19			
3	095	21	7	230	19	430	4.458	17
4	074	20	8	211	18	1	441	18
5	054	21	9	193	19	2	423	17
6	033	20				3	406	17
7	013	21	390	174	19	4	389	17
8	5.992	20	1	155	18	5	372	17
9	972	20	2	137	19	6	355	17
			3	118	18	7	338	17
350	952	21	4	100	19	8	321	17
1	931	20	5	081	18	9	304	17
2	911	20	6	063	18			
3	891	20	7	045	19	440	287	17
4	871	20	8	026	18	1	270	17
5	851	20	9	008	18	2	253	17
6	831	20				3	236	17
7	811	20	400	4.990	18	4	219	16
8	791	20	1	972	19	5	203	17
9	771	20	2	953	18	6	186	17
			3	935	18	7	169	16
360	751	20	4	917	18	8	153	17
1	731	20	5	899	18	9	136	17
2	711	20	6	881	18			
3	691	19	7	863	18	450	119	16
4	672	20	8	845	18	1	103	17
5	652	20	9	827	18	2	086	16
6	632	19				3	070	17
7	613	20	410	809	18	4	053	16
8	593	19	1	791	18	5	037	17
9	574	20	2	773	18	6	020	16
			3	755	17	7	004	17
370	5.554	19	4	738	18	8	3.987	16
1	535	19	5	720	18	9	971	17
2	516	20	6	702	18			
3	496	19	7	684	17	460	3.954	16
4	477	19	8	667	18	1	938	16
5	458	19	9	649	17	2	922	16
6	439	20				3	906	17
7	419	19	420	632	18	4	889	16
8	400	19	1	614	17	5	873	16

F. A. I. CONVERSION TABLE

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P	Z	Δz	P	Z	Δz	P	Z	Δz
6	857	16	510	171	15	5	516	
7	841	16	1	156	15	6	502	14
8	825	17	2	141	15	7	488	14
9	808	16	3	126	15	8	474	14
			4	111	15	9	460	14
470	792	16	5	096	15			14
1	776	16	6	081	15	560	446	
2	760	16	7	066	15	1	432	14
3	744	16	8	051	15	2	418	14
4	728	16	9	036	15	3	404	14
5	712	15			15	4	390	14
6	697	16	520	3.021	15	5	376	14
7	681	16	1	006	15	6	362	14
8	665	16	2	2.991	14	7	348	14
9	649	16	3	977	15	8	334	14
			4	962	15	9	321	13
			5	947	15			14
480	633	16	6	933	14			
1	617	15	7	918	15	570	307	14
2	602	16	8	903	15	1	293	14
3	586	16	9	889	14	2	279	14
4	570	15			15	3	266	13
5	555	16				4	252	14
6	539	16	530	874	15	5	238	14
7	523	16	1	859	14	6	224	14
8	508	15	2	845	15	7	211	13
9	492	16	3	830	14	8	197	14
			4	816	15	9	184	13
			5	801	14			14
490	3.476	15	6	787	15			
1	461	16	7	772	14	580	2.170	13
2	445	15	8	758	15	1	157	13
3	430	16	9	743	14	2	144	14
4	414	15				3	130	14
5	399	15				4	116	14
6	384	16	540	729	14	5	102	14
7	368	15	1	715	15	6	089	13
8	353	15	2	700	14	7	075	14
9	338	16	3	686	15	8	062	13
			4	672	14	9	049	13
			5	657	14			14
500	322	15	6	643	14			
1	307	15	7	629	14	590	035	13
2	292	16	8	615	15	1	022	14
3	276	15	9	600	14	2	008	13
4	261	15				3	1.995	13
5	246	15	550	2.586	14	4	982	13
6	231	15	1	572	14	5	969	13
7	216	15	2	558	14	6	955	14
8	201	15	3	544	14	7	942	13
9	186	15	4	530	14	8	929	13
					14			14

P	Z	Δz	P	Z	Δz	P	Z	Δz
9	915	13	2	616	13	6	314	13
600	902	13	3	603	12	7	301	12
1	889	13	4	591	13	8	289	13
2	876	13	5	578	13	9	276	12
3	863	13	6	565	13			
4	850	13	7	552	12	650	264	12
5	837	13	8	540	13	1	252	12
6	823	14	9	527	13	2	240	13
7	810	13				3	227	12
8	797	13	630	514	12	4	215	12
9	784	13	1	502	13	5	203	13
			2	489	13	6	190	12
			3	476	12	7	178	12
610	1.771	13	4	464	13	8	166	12
1	758	13	5	451	12	9	154	12
2	745	13	6	439	13			
3	732	13	7	426	13	660	142	13
4	719	13	8	413	12	1	129	12
5	706	13	9	401	13	2	117	12
6	693	13				3	105	12
7	680	12	640	1.388	12	4	093	12
8	668	13	1	376	13	5	081	12
9	655	13	2	363	12	6	069	12
			3	351	13	7	057	12
620	642	13	4	338	12	8	045	12
1	629	13	5	326	12	9	033	12

PART II

**Addenda to the Rules and Regulations
Governing Sporting Events and Records
of the
Fédération Aéronautique Internationale**

CHAPTER III

F. A. I. TIMERS' EXAMINATION

Addenda to F. A. I. Rules and Regulations for Aeronautic Events and Recognized Record Trials

Regulations governing the admission of Official Timekeepers:

Article 1

In order to be appointed the candidate must

(1) Be proposed by the Club or the National Federation.

(2) Pass in the presence of an Official Timer an examination consisting of the practical timing of airplanes during the following flights:

(a) Three trials of less than a kilometer. (Four times over course, twice in each direction constitutes one trial.) See page 158, Par. 4 (b).

(b) A trial of more than ten kilometers. The candidate must take the time of at least ten passages using a "stop watch with two split second hands."

During the above trials the candidate shall enter the times observed by him, in ink, upon the standard timing sheet, copies of which can be obtained from the Contest Committee of the Aero Club. The Official Timers observing this examination shall also time the trials and enter their times on separate official sheets.

Article 1-(3); Article 2

And, without help of any ready reckoner, calculate the speeds (15 in all) which would have resulted from the times of any five different flights over the course in Article 1-(2-a) assuming this course measures

(a) 333.33 meters = (1093.6 ft.)

(b) 400 meters = (1312.33 ft.)

(c) 1,609.314 meters = English mile or 5,280 ft.

Article 3

These calculations shall be made in the presence of the Official Timers who shall take note of the time required for computation. The Official Timer shall not assist or allow any assistance or advice to be given the candidate while figuring the above speeds.

Article 4

The candidate then gives his sheets of timekeeping and calculations to the Official Timekeeper in a sealed envelope. After the completion of all examinations, the Official Timekeeper sends the

envelopes and his correct times and calculations to the Contest Committee together with a statement specifying that the examination has been honestly carried out and that there have been neither communication of results nor corrections.

Article 5

This examination may be made on an airdrome. In all cases the costs for fees and traveling expenses of the Official Timekeeper are charged against the candidate or the club that proposed him. Several candidates may undergo the examination at the same time. In this case the charges are divided among the candidates who take the examination.

Article 6

The Contest Committee passes upon the candidates after examining their, and the official papers. A rejected candidate may take the examination over again at the expiration of one month.

Article 7

The candidates having passed the examination, are appointed Official Timekeepers of the F. A. I.

Article 8

The Official Timekeepers of the F. A. I. must have at their disposal at all times, a double-needle split-second stop watch, provided with a certificate of performance (first or second class) obtained from any of the following observatories:

Besancon (France)
Geneva (Switzerland)
Kew (England)
Neuchatel (Switzerland)

NOTE: Pending official recognition by the F. A. I. of an observatory in the U. S. A., certificates shall be obtained from the Washington Observatory.

By Chairman, Contest Committee Aero Club of America.

Article 9

Any National Federation may, at its discretion, require the Timekeepers to obtain new certificates for their stop watches. This renewal of certificates is obligatory every two years.

Article 10

Official Timekeepers may only accept such fees as are fixed or approved by the National Federation.

CHAPTER IV

AVIATORS' CERTIFICATES

Pending action being taken by the United States Government concerning the examination and licensing of aviators the Aero Club of America will grant aviators' certificates to those who pass the following examinations which were drawn up at the Convention for the Regulation of Air Navigation (October 13, 1919) Amended Text as Signed by the United States of America with Reservations.

NOTE: Aviators' annual licenses required by F. A. I. Rules, for sanctioned meets (Art. a-31) are granted to recognized aviators in good standing by the Aero Club of America without examination or charge.

CERTIFICATE OF FLIGHTS

Instructions Governing the Conduct of Tests for Aviators' Certificates

Candidates must accomplish the two following tests, each being a separate flight:

Test A

A flight without landing, during which the pilot shall remain for at least an hour at a minimum altitude of 2,000 meters (6562 feet) above the point of departure. The descent shall finish with a glide, the engines cut off at 1,500 meters (4921 feet) above the landing ground. The landing shall be made within 150 meters (492 feet) or less of a point fixed beforehand by the official examiners of the test without starting the engine again.

Test B

A flight without landing round two posts (or buoys) situated 500 meters (1604.4 feet) apart, making a series of five figure-of-eight turns, each turn reaching one of the two posts (or buoys). This flight shall be made at an altitude of not more than 200 meters (656 feet) above the ground (or water) without touching the ground (or water). The landing shall be effected by:

1. Finally shutting off the engine or engines at latest when the aircraft touches the ground (or water).
2. Finally stopping the aircraft within a distance of 50 meters (164 feet) from a point fixed by the candidate before starting.

The candidate must be alone in the aircraft during the two tests. In flights for hydro-aeroplane certificate, starting from and landing on the water is permitted for all of the tests.

The course on which the candidate accomplishes the test "B" must be marked out by two posts or buoys situated not more than 500 meters (1640.4 feet) apart.

The turns round the posts or buoys must be made alternately to the right and to the left, so that the flight will consist of an uninterrupted series of five figure-of-eight turns.

The issuance of the certificate is always discretionary.

The responsible representative of the Contest Committee is charged with the supervision of the tests and is responsible for the preparation and accuracy of the reports which must be dated, signed and returned to the Chairman of the Contest Committee as soon as practicable after the completion of the test.

The responsible representative must see that the posts or buoys about which the aviators turn are located at a distance not greater than 500 meters (1640.4 feet) apart, and shall note in the report the way in which the distance between the posts or buoys was measured, whether by chain, steel tape, metallic tape, etc., etc.

An observer must be stationed in the close vicinity of each post to see that the turns are made in the proper order, direction and number.

While extremely desirable it is not necessary that all the tests should be made on the same day.

Under the heading of "Remarks" the time of day and weather condition should be noted and the comment of the responsible representative as to the manner in which the applicant handles his machine.

Fee of \$5.00 must accompany application.

Two photographs of candidate must be attached, size $2\frac{1}{4} \times 2\frac{1}{2}$ inches.

Name in full of Candidate.....

Date and Place of Birth.....

Nationality

Address

Description of Aircraft.....Motor.....H. P.....

Name of School.....Place.....

Date of Tests.....Time.....

The Observers Are Required to Fill in the Answers to the Following Questions:

A. Duration and Altitude (See Regulations on opposite page).

Did candidate remain at a minimum altitude of 2,000 meters throughout a period of at least one hour?.....

Was the descent made from 1,500 meters with the motor cut off throughout?

Was the alighting made in view of the observers?.....

Was the alighting made in a satisfactory manner?.....

B. Distance Flight (See Regulations on opposite page).

Was the flight made in accordance with provisions in Test "B" printed on opposite page?.....

Alighting:

Was the alighting made on land or water?.....

Was the alighting carried out in a satisfactory manner?.....

At what distance from the mark did the aircraft come to rest?.....

How was course measured and how marked?.....

General Remarks

.....

..... Date.....

(We certify that the foregoing is a correct and true record.)

Signature of Responsible Representative.....

Address

.....

Signature of Observer.....

Address

.....

This Certificate, when completed, must be forwarded without delay to the Aero Club of America.

BALLOON PILOT CERTIFICATES

Issued by the Aero Club of America.

Balloon pilot certificates are issued to those passing the following examinations:

NOTE: Pilots' annual licenses required by F. A. I. Rules for sanctioned meets (Art. a-21) are granted to recognized pilots in good standing by the Aero Club of America without examination or charge.

1. Practical Tests

The candidate must have completed the following certified ascents:

(a) By day: 3 ascents under instruction; 1 ascent in control under supervision; 1 ascent alone in the balloon.

(b) By night: 1 ascent alone in the balloon. Each ascent shall be of at least two hours' duration.

2. Theoretical Tests

Elementary aerostatics and meteorology.

3. Special Requirements

General knowledge of a balloon and its accessories; inflation; rigging; management of an ascent; instruments; precautions against cold and high altitudes.

Knowledge of Rules as to Lights and Signals and Rules of the Air; *Rules for Air Traffic on and in the Vicinity of Aerodromes.**Practical knowledge of international air legislation. Map reading and orientation.*

DIRIGIBLE PILOT CERTIFICATES

Issued by the Aero Club of America.

Every dirigible pilot shall have qualified as pilot of a free balloon.

Dirigible pilot certificates are issued to those passing the following examinations:

Practical Tests

(a) Twenty certified flights (three of which shall be by night) in a dirigible, each flight being of at least one hour's duration. In at least four of these flights the candidate must have handled the dirigible himself, under the supervision of the commanding officer of the dirigible, including ascent and landing.

(b) One cross country flight on a predetermined course of at least 100 kilometers (62.137) miles, terminating with a night landing, and made with a duly authorized inspector on board.

Theoretical Examination

Aerostatics and meteorology. (Density of gases, laws of Mariette and of Gay-Lussac; barometric pressure, Archimedes principle; confinement of gases; interpretation and use of meteorological information and of weather charts.)

Physical and chemical properties of light gases, and of materials used in the construction of dirigibles.

General theory of dirigibles.

Dynamic properties of moving bodies in air.

General Knowledge

Elementary knowledge of internal combustion engines.

Elementary navigation; use of the compass; location of position.

Inflation; stowage; rigging; handling; controls and instruments.

SECTION FIVE

Aero Club of America

Reference Tables

CHAPTER I

SPEED FORMULAE

Rate of speed for mile and kilometer trials, see following speed tables and their formulae.

Rate of Speed From Elapsed Time and Distance

To find the rate of speed in miles per hour (m. p. h.) from total distance covered and elapsed time, multiply the distance by 3600 and divide by the elapsed time in seconds.

Formulae

$$\text{M.P.H.} = \frac{\text{distance} \times 3600}{\text{elapsed time (in seconds)}}$$

Example

Distance = 105.5 miles.

Elapsed time = 1 hr., 53 m., 32 s. or 113 m., 32 s. or 6812 seconds.

The above formula then becomes

$$\text{M. P. H.} = \frac{105.5 \times 3600}{6812} = \frac{379800}{6812} = 55.754 \text{ miles per hr.}$$

To convert miles into kilometers, multiply the miles by 1.6093.

To convert kilometers into miles, multiply the kilometers by .62137.

NOTE: Conversion tables miles to kilometers and kilometers to miles, use following speed tables.

Formula for Cross Wind Correction

V = true air speed of airplane.

G = mean of observed speeds in both directions over a straight course.

W = wind speed.

B = angle of wind to course.

$$V = \sqrt{G^2 + W^2 \cdot \sin^2 B}$$

NOTE: To obtain sine B, for use in above formula, refer to next table.

To find square root of a number proceed as follows:

Point off the given number into periods of two places each, beginning with units. If they are decimals, point these off likewise, beginning at the decimal point, and supplying as many ciphers as may be needed. Find the greatest number whose square is less than the first left-hand period, and place it as the first figure in the quotient. Subtract its square from the left-hand period, and to the remainder annex the two figures of the second period for a dividend. Double the first figure of the quotient for a partial divisor; find how many times the latter is contained in the dividend exclusive of the right-hand figure, and set the figure representing that number of times as the second figure in the quotient, and annex it to the right of the partial divisor, forming the complete divisor. Multiply this divisor by the second figure in the quotient and subtract the product from the dividend. To the remainder bring down the next period and proceed as before, in each case doubling the figures in the root already found to obtain the trial divisor. Should the product of the second figure in the root by the completed divisor be greater than the dividend, erase the second figure both from the quotient and from the divisor, and substitute the next smaller figure, or one small enough to make the product of the second figure by the divisor less than or equal to the dividend.

Square Root

	3.1415926536	1.77245+
	1	
27	2 14	
	1 89	
347	2515	
	2429	
3542	8692	
	7084	
35444	160865	
	141776	
354485	1908936	
	1772425	

CHAPTER II

TRIGONOMETRICAL FUNCTIONS

For use in Cross Wind Correction Formulae.

Natural Sine.

Deg.	Min.	Sine	Deg.	Min.	Sine	Deg.	Min.	Sine
0	0	1.0000		30	.16505	19	0	.32557
	15	.00436		45	.16935		15	.32969
	30	.00873	10	0	.17365		30	.33381
	45	.01309		15	.17794		45	.33792
1	0	.01745		30	.18224	20	0	.34202
	15	.02181		45	.18652		15	.34612
	30	.02618	11	0	.19081		30	.35021
	45	.03054		15	.19509		45	.35429
2	0	.03490		30	.19937	21	0	.35837
	15	.03926		45	.20364		15	.36244
	30	.04362	12	0	.20791		30	.36650
	45	.04798		15	.21218		45	.37056
3	0	.05234		30	.21644	22	0	.37461
	15	.05669		45	.22070		15	.37865
	30	.06105	13	0	.22495		30	.38268
	45	.06540		15	.22920		45	.38671
4	0	.06976		30	.23345	23	0	.39073
	15	.07411		45	.23769		15	.39474
	30	.07846	14	0	.24192		30	.39875
	45	.08281		15	.24615		45	.40275
5	0	.08716		30	.25038	24	0	.40674
	15	.09150		45	.25460		15	.41072
	30	.09585	15	0	.25882		30	.41469
	45	.10019		15	.26303		45	.41866
6	0	.10453		30	.26724	25	0	.42262
	15	.10887		45	.27144		15	.42657
	30	.11320	16	0	.27564		30	.43051
	45	.11754		15	.27983		45	.43445
7	0	.12187		30	.28402	26	0	.43837
	15	.12620		45	.28820		15	.44229
	30	.13053	17	0	.29237		30	.44620
	45	.13485		15	.29654		45	.45010
8	0	.13917		30	.30070	27	0	.45399
	15	.14349		45	.30486		15	.45787
	30	.14781	18	0	.30902		30	.46175
	45	.15212		15	.31316		45	.46561
9	0	.15643		30	.31730	28	0	.46947
	15	.16074		45	.32144		15	.47332

Deg.	Min.	Sine	Deg.	Min.	Sine	Deg.	Min.	Sine
29	30	.47716	41	15	.64612	52	0	.78801
	45	.48099		30	.64945		15	.79069
	0	.48481		45	.65276		30	.79335
	15	.48862		0	.65606		45	.79600
30	30	.49242	42	15	.65935	53	0	.79864
	45	.49622		30	.66262		15	.80125
	0	.50000		45	.66588		30	.80386
	15	.50377		0	.66913		45	.80644
31	30	.50754	43	15	.67237	54	0	.80902
	45	.51129		30	.67559		15	.81157
	0	.51504		45	.67880		30	.81412
	15	.51877		0	.68200		45	.81664
32	30	.52250	44	15	.68518	55	0	.81915
	45	.52621		30	.68835		15	.82165
	0	.52992		45	.69151		30	.82413
	15	.53361		0	.69466		45	.82659
33	30	.53730	45	15	.69779	56	0	.82904
	45	.54097		30	.70091		15	.83147
	0	.54464		45	.70401		30	.83389
	15	.54829		0	.70711		45	.83629
34	30	.55194	46	15	.71019	57	0	.83867
	45	.55557		30	.71325		15	.84104
	0	.55919		45	.71630		30	.84339
	15	.56280		0	.71934		45	.84573
35	30	.56641	47	15	.72236	58	0	.84805
	45	.57000		30	.72537		15	.85035
	0	.57358		45	.72837		30	.85264
	15	.57715		0	.73135		45	.85491
36	30	.58070	48	15	.73432	59	0	.85717
	45	.58425		30	.73728		15	.85941
	0	.58779		45	.74022		30	.86163
	15	.59131		0	.74314		45	.86384
37	30	.59482	49	15	.74606	60	0	.86603
	45	.59832		30	.74896		15	.86820
	0	.60181		45	.75184		30	.87036
	15	.60529		0	.75471		45	.87250
38	30	.60876	50	15	.75756	61	0	.87462
	45	.61222		30	.76041		15	.87673
	0	.61566		45	.76323		30	.87882
	15	.61909		0	.76604		45	.88089
39	30	.62251	51	15	.76884	62	0	.88295
	45	.62592		30	.77162		15	.88499
	0	.62932		45	.77439		30	.88701
	15	.63271		0	.77715		45	.88902
40	30	.63608		15	.77988	63	0	.89101
	45	.63944		30	.78261		15	.89298
	0	.64279		45	.78532		30	.89498

Deg.	Min.	Sine.	Deg.	Min.	Sine.	Deg.	Min.	Sine.
64	45	.89687	73	30	.95372	82	15	.98836
	0	.89879		45	.95502		30	.98902
	15	.90070		0	.95630		45	.98965
	30	.90259		15	.95757		0	.99027
65	45	.90446	74	30	.95882	83	15	.99086
	0	.90631		45	.96005		30	.99144
	15	.90814		0	.96126		45	.99200
	30	.90996		15	.96246		0	.99255
66	45	.91176	75	30	.96363	84	15	.99307
	0	.91355		45	.96479		30	.99357
	15	.91531		0	.96593		45	.99406
	30	.91706		15	.96705		0	.99452
67	45	.91879	76	30	.96815	85	15	.99497
	0	.92050		45	.96923		30	.99540
	15	.92220		0	.97030		45	.99580
	30	.92388		15	.97134		0	.99619
68	45	.92554	77	30	.97237	86	15	.99656
	0	.92718		45	.97338		30	.99692
	15	.92881		0	.97437		45	.99725
	30	.93042		15	.97534		0	.99756
69	45	.93201	78	30	.97630	87	15	.99786
	0	.93358		45	.97723		30	.99813
	15	.93514		0	.97815		45	.99839
	30	.93667		15	.97905		0	.99863
70	45	.93819	79	30	.97992	88	15	.99885
	0	.93969		45	.98079		30	.99905
	15	.94118		0	.98163		45	.99923
	30	.94264		15	.98245		0	.99939
71	45	.94409	80	30	.98325	89	15	.99953
	0	.94552		45	.98404		30	.99966
	15	.94693		0	.98481		45	.99976
	30	.94832		15	.98556		0	.99985
72	45	.94970	81	30	.98629		15	.99991
	0	.95106		45	.98700		30	.99996
	15	.95240		0	.98769		45	.99999

CHAPTER III

SPEED TABLE OVER MILE COURSE

Notation: This table is for approximate reference.

Use formula for accurate figures.

No. 1. To find kilometers per hour from elapsed time over one mile:

n = elapsed time in seconds

5793.48 = constant

$$\frac{5793.48}{n} = \text{M.P.H.}$$

Example:

n = 14.40 seconds therefore

$$\frac{5793.48}{14.4} = 402.32 \text{ plus M.P.H.}$$

No. 2. To find miles per hour from elapsed time over one mile:

n = elapsed time in seconds

3600 = constant

$$\frac{3600}{n} = \text{M.P.H.}$$

Example:

n = 14.40 seconds therefore

$$\frac{3600}{14.4} = 250.00 \text{ M.P.H.}$$

NOTE: The recognized speed of an aeroplane is the average of four trips over the course, two in each direction. The resultant speed must be taken as the average of the speeds in miles or kilometers per hour, without any correction.

Time for 1 mile Sec.	Equal to miles per hour	or	Equal to kilometers per hour	Time for 1 mile Sec.	Equal to miles per hour	or	Equal to kilometers per hour
14.40	250.00		402.34	15.45	233.01		374.99
14.45	249.14		400.96	15.50	232.26		373.79
14.50	248.28		399.57	15.55	231.51		372.58
14.55	247.42		398.19	15.60	230.77		371.39
14.60	246.58		396.83	15.65	230.03		370.20
14.65	245.73		395.46	15.70	229.30		369.02
14.70	244.90		394.13	15.75	228.57		367.85
14.75	244.07		392.79	15.80	227.85		366.69
14.80	243.24		391.46	15.85	227.13		365.53
14.85	242.43		390.15	15.90	226.42		364.39
14.90	241.61		388.83	15.95	225.71		363.25
14.95	240.80		387.53	16.00	225.00		362.10
15.00	240.00		386.24	16.05	224.30		360.98
15.05	239.20		384.95	16.10	223.60		359.85
15.10	238.41		383.68	16.15	222.91		358.84
15.15	237.62		382.42	16.20	222.22		357.63
15.20	236.84		381.16	16.25	221.54		356.54
15.25	236.07		379.92	16.30	220.86		355.44
15.30	235.29		378.66	16.35	220.18		354.35
15.35	234.53		377.44	16.40	219.51		353.27
15.40	233.77		376.22	16.45	218.84		352.19

SPEED TABLE OVER MILE COURSE—Continued

Time for 1 mile Sec.	Equal to miles per hour	or	Equal to kilometers per hour	Time for 1 mile Sec.	Equal to miles per hour	or	Equal to kilometers per hour
16.50	218.18		351.13	18.75	192.00		308.99
16.55	217.52		350.07	18.80	191.49		308.17
16.60	216.86		349.00	18.85	190.98		307.35
16.65	216.21		347.96	18.90	190.48		306.55
16.70	215.57		346.93	18.95	189.97		305.73
16.75	214.92		345.88	19.00	189.47		304.92
16.80	214.29		344.87	19.05	188.98		304.13
16.85	213.65		343.84	19.10	188.48		303.33
16.90	213.02		342.82	19.15	187.99		302.54
16.95	212.39		341.81	19.20	187.50		301.75
17.00	211.76		340.80	19.25	187.01		300.97
17.05	211.14		339.80	19.30	186.53		300.19
17.10	210.53		338.82	19.35	186.05		299.42
17.15	209.91		337.82	19.40	185.57		298.65
17.20	209.30		336.84	19.45	185.09		297.87
17.25	208.69		335.86	19.50	184.62		297.12
17.30	208.09		334.89	19.55	184.14		296.35
17.35	207.49		333.92	19.60	183.67		295.59
17.40	206.90		332.98	19.65	183.21		294.85
17.45	206.30		332.01	19.70	182.74		294.09
17.50	205.71		331.06	19.75	182.28		293.35
17.55	205.13		330.13	19.80	181.82		292.61
17.60	204.55		329.19	19.85	181.36		291.87
17.65	203.97		328.26	19.90	180.90		291.13
17.70	203.39		327.33	19.95	180.45		290.40
17.75	202.82		326.41	20.00	180.00		289.68
17.80	202.25		325.49	20.10	179.10		288.23
17.85	201.68		324.57	20.20	178.22		286.82
17.90	201.12		323.67	20.30	177.34		285.40
17.95	200.56		322.77	20.40	176.47		284.00
18.00	200.00		321.87	20.50	175.61		282.62
18.05	199.45		320.99	20.60	174.76		281.25
18.10	198.90		320.10	20.70	173.91		279.88
18.15	198.35		319.21	20.80	173.08		278.55
18.20	197.80		318.33	20.90	172.25		277.21
18.25	197.26		317.46	21.00	171.43		275.89
18.30	196.72		316.59	21.10	170.62		274.59
18.35	196.19		315.74	21.20	169.81		273.28
18.40	195.66		314.89	21.30	169.02		272.01
18.45	195.12		314.02	21.40	168.23		270.74
18.50	194.59		313.16	21.50	167.44		269.47
18.55	194.07		312.33	21.60	166.67		268.23
18.60	193.55		311.49	21.70	165.90		266.99
18.65	193.03		310.65	21.80	165.14		265.77
18.70	192.52		309.83	21.90	164.38		264.55

SPEED TABLE OVER MILE COURSE—Continued

Time for 1 mile Sec.	Equal to miles per hour	or	Equal to kilometers per hour	Time for 1 mile Sec.	Equal to miles per hour	or	Equal to kilometers per hour
22.00	163.64		263.35	29	124.13		199.76
22.10	162.90		262.16	1-5	123.28		198.40
22.20	162.16		260.97	2-5	122.45		197.06
22.30	161.44		259.81	3-5	121.62		195.73
22.40	160.71		258.64	4-5	120.80		194.41
22.50	160.00		257.50	30	120.00		193.12
22.60	159.29		256.35	1-5	119.20		191.84
22.70	158.59		255.23	2-5	118.42		190.58
22.80	157.89		254.10	3-5	117.64		189.32
22.90	157.21		253.01	4-5	116.88		188.10
23.00	156.52		251.90	31	116.13		186.89
23.10	155.84		250.80	1-5	115.38		185.68
23.20	155.17		249.72	2-5	114.65		184.51
23.30	154.51		248.66	3-5	113.90		183.30
23.40	153.85		247.60	4-5	113.21		182.17
23.50	153.19		246.54	32	112.50		181.05
23.60	152.55		245.51	1-5	111.80		179.92
23.70	151.90		244.46	2-5	111.11		178.81
23.80	151.26		243.43	3-5	110.43		177.71
23.90	150.63		242.42	4-5	109.75		176.62
24	150.00		241.40	33	109.09		175.56
1-5	148.76		239.41	1-5	108.43		174.50
2-5	147.54		237.44	2-5	107.78		173.46
3-5	146.34		235.51	3-5	107.14		172.43
4-5	145.16		233.61	4-5	106.51		171.41
25	144.00		231.74	34	105.88		170.40
1-5	142.86		229.91	1-5	105.26		169.40
2-5	141.73		228.09	2-5	104.65		168.42
3-5	140.62		226.31	3-5	104.04		167.43
4-5	139.53		224.54	4-5	103.45		166.48
26	138.46		222.83	35	102.85		165.52
1-5	137.40		221.12	1-5	102.27		164.58
2-5	136.36		219.45	2-5	101.69		163.65
3-5	135.34		217.81	3-5	101.12		162.73
4-5	134.33		216.18	4-5	100.56		161.83
27	133.33		214.57	36	100.00		160.93
1-5	132.35		213.00	1-5	99.44		160.03
2-5	131.38		211.44	2-5	98.90		159.16
3-5	130.43		209.91	3-5	98.36		158.29
4-5	129.50		208.41	4-5	97.82		157.42
28	128.57		206.91	37	97.29		156.57
1-5	127.66		205.45	1-5	96.77		155.73
2-5	126.76		204.00	2-5	96.25		154.90
3-5	125.87		202.57	3-5	95.74		154.07
4-5	125.00		201.17	4-5	95.23		153.2

SPEED TABLE OVER MILE COURSE—Continued

Time for 1 mile Sec.	Equal to miles per hour	or	Equal to kilometers per hour	Time for 1 mile Sec.	Equal to miles per hour	to	Equal to kilometers per hour
38	94.73		152.45	47	76.59		123.26
1-5	94.24		151.65	1-5	76.27		122.74
2-5	93.75		150.86	2-5	75.95		122.23
3-5	93.26		150.07	3-5	75.61		121.71
4-5	92.78		149.30	4-5	75.31		121.20
39	92.30		148.54	48	75.00		120.70
1-5	91.83		147.79	1-5	74.68		120.18
2-5	91.37		147.05	2-5	74.38		119.70
3-5	90.91		146.31	3-5	74.07		119.21
4-5	90.45		145.57	4-5	73.77		118.73
40	90.00		144.84	49	73.47		118.24
1-5	89.55		144.12	1-5	73.17		117.76
2-5	89.11		143.41	2-5	72.87		117.28
3-5	88.67		142.71	3-5	72.58		116.81
4-5	88.25		142.03	4-5	72.29		116.34
41	87.80		141.30	50	72.00		115.87
1-5	87.38		140.63	1-5	71.71		115.41
2-5	86.95		139.93	2-5	71.42		114.94
3-5	86.53		139.26	3-5	71.14		114.49
4-5	86.12		138.60	4-5	70.86		114.04
42	85.71		137.94	51	70.58		113.59
1-5	85.30		137.27	1-5	70.31		113.15
2-5	84.90		136.63	2-5	70.04		112.72
3-5	84.50		135.99	3-5	69.76		112.27
4-5	84.11		135.36	4-5	69.49		111.84
43	83.72		134.73	52	69.23		111.42
1-5	83.33		134.10	1-5	68.96		110.98
2-5	82.95		133.50	2-5	68.70		110.56
3-5	82.57		132.88	3-5	68.44		110.15
4-5	82.19		132.27	4-5	68.18		109.73
44	81.81		131.66	53	67.92		109.31
1-5	81.44		131.06	1-5	67.66		108.89
2-5	81.08		130.49	2-5	67.41		108.49
3-5	80.71		129.89	3-5	67.16		108.08
4-5	80.35		129.31	4-5	66.91		107.68
45	80.00		128.75	54	66.66		107.28
1-5	79.64		128.17	1-5	66.42		106.89
2-5	79.29		127.61	2-5	66.17		106.49
3-5	78.94		127.04	3-5	65.93		106.10
4-5	78.60		126.50	4-5	65.69		105.72
46	78.26		125.95	55	65.45		105.33
1-5	77.92		125.40	1-5	65.21		104.94
2-5	77.58		124.85	2-5	64.98		104.57
3-5	77.25		124.32	3-5	64.74		104.19
4-5	76.92		123.79	4-5	64.51		103.82

SPEED TABLE OVER MILE COURSE—Continued

Time for 1 mile Sec.	Equal to miles per hour	to Equal to kilometers per hour	Time for 1 mile Sec.	Equal to miles per hour	or Equal to kilometers per hour
56	64.28	103.45	58	62.07	99.89
1-5	64.05	103.08	1-5	61.85	99.45
2-5	63.83	102.73	2-5	61.64	99.20
3-5	63.60	102.36	3-5	61.43	98.87
4-5	63.38	102.01	4-5	61.22	98.53
57	63.16	101.65	59	61.01	98.19
1-5	62.93	101.28	1-5	60.81	97.87
2-5	62.71	100.93	2-5	60.60	97.53
3-5	62.50	100.59	3-5	60.40	97.21
4-5	62.28	100.24	4-5	60.20	96.88

CHAPTER IV

SPEED TABLE OVER KILOMETER COURSE

Notation: This table is for approximate reference.

Use formula for accurate figures.

No. 1. To find kilometers per hour from elapsed time over one kilometer:

n = elapsed time in seconds
3600 = constant

$$\frac{3600}{n} = \text{kilometers per hr.}$$

Example:

$n = 8.93$ seconds therefore
3600

$$8.93 = 403.135 \text{ plus km. h.}$$

Average in miles per hour, etc.

No. 2. To find miles per hour from elapsed time over one kilometer:

n = elapsed time in seconds
2237.04 = constant

$$\frac{2237.04}{n} = \text{M.P.H.}$$

Example:

$n = 8.93$ seconds therefore

$$\frac{2237.04}{8.93} = 250.50 \text{ plus M.P.H.}$$

NOTE: The recognized speed of an aeroplane is the average of four trips over the course, two in each direction. The resultant speed must be taken as the average of the speeds in miles or kilometers per hour, without any correction.

Time for 1 Kilom. Sec.	Kilometers per hour	or	Miles per hour	Time for 1 Kilom. Sec.	Kilometers per hour	or	Miles per hour
8.92	403.59		250.78	9.32	386.27		240.02
8.95	402.24		249.94	9.35	385.44		239.50
8.97	401.34		249.38	9.37	384.21		238.74
9.00	400.00		248.55	9.40	382.98		237.97
9.02	399.11		248.00	9.42	382.17		237.47
9.05	397.79		247.17	9.45	380.95		236.71
9.07	396.91		246.63	9.47	380.15		236.21
9.10	395.61		245.82	9.50	378.95		235.47
9.12	394.74		245.28	9.52	378.15		234.97
9.15	393.44		244.47	9.55	376.98		234.24
9.17	392.59		243.94	9.57	376.18		233.75
9.20	391.30		243.14	9.60	375.00		233.01
9.22	390.46		242.62	9.62	374.22		232.53
9.25	389.19		241.83	9.65	373.06		231.81
9.27	388.35		241.31	9.67	372.29		231.33
9.30	387.10		240.53	9.70	371.13		230.61

SPEED TABLE OVER KILOMETER COURSE—Continued

Time for 1 Kilom. Sec.	Kilometers per hour	or	Miles per hour	Time for 1 Kilom. Sec.	Kilometers per hour	or	Miles per hour
9.72	370.37		230.14	11.45	314.41		195.37
9.75	369.23		229.43	11.50	313.04		194.51
9.77	368.48		228.96	11.55	311.69		193.68
9.80	367.35		228.26	11.60	310.34		192.84
9.82	366.60		227.79	11.65	309.01		192.01
9.85	365.48		227.10	11.70	307.69		191.19
9.87	364.74		226.64	11.75	306.39		190.38
9.90	363.64		225.96	11.80	305.09		189.57
9.92	362.90		225.50	11.85	303.80		188.77
9.95	361.81		224.82	11.90	302.52		187.98
9.97	361.08		224.37	11.95	301.25		187.19
10.00	360.00		223.69	12.00	300.00		186.41
10.02	359.28		223.25	12.05	298.75		185.63
10.05	358.21		222.58	12.10	297.52		184.87
10.07	357.50		222.14	12.15	296.30		184.11
10.10	356.44		221.48	12.20	295.08		183.35
10.12	355.73		221.04	12.25	293.88		182.61
10.15	354.68		220.39	12.30	292.68		181.86
10.17	353.98		219.95	12.35	291.50		181.13
10.20	352.94		219.31	12.40	290.32		180.40
10.22	352.25		218.88	12.45	289.16		179.68
10.25	351.22		218.24	12.50	288.00		178.95
10.30	349.52		217.18	12.55	286.85		178.24
10.35	347.83		216.13	12.60	285.71		177.53
10.40	346.15		215.09	12.65	284.59		176.84
10.45	344.49		214.06	12.70	283.47		176.14
10.50	342.86		213.04	12.75	282.35		175.44
10.55	341.23		212.03	12.80	281.25		174.76
10.60	339.63		211.04	12.85	280.15		174.08
10.65	338.03		210.04	12.90	279.07		173.41
10.70	336.45		209.06	12.95	277.99		172.73
10.75	334.88		208.09	13.00	276.92		172.07
10.80	333.33		207.12	13.05	275.86		171.41
10.85	331.80		206.17	13.10	274.81		170.76
10.90	330.27		205.22	13.15	273.76		170.11
10.95	328.77		204.29	13.20	272.73		169.47
11.00	327.27		203.36	13.25	271.70		168.83
11.05	325.79		202.44	13.30	270.68		168.19
11.10	324.32		200.62	13.35	269.66		167.56
11.15	322.87		200.62	13.40	268.66		166.94
11.20	321.43		199.73	13.45	267.66		166.32
11.25	320.00		198.84	13.50	266.67		165.70
11.30	318.58		197.96	13.55	265.68		165.08
11.35	317.18		197.09	13.60	264.71		164.46
11.40	315.79		196.22	13.65	263.74		163.83

SPEED TABLE OVER KILOMETER COURSE—Continued

Time for 1 Kilom. Sec.	Kilometers per hour	or	Miles per hour	Time for 1 Kilom. Sec.	Kilometers per hour	or	Miles per hour
13.70	262.77		163.28	15.95	225.71		140.25
13.75	261.82		162.69	16.00	225.00		139.81
13.80	260.87		162.10	16.05	224.30		139.37
13.85	259.93		161.51	16.10	223.60		138.94
13.90	258.99		160.93	16.15	222.91		138.51
13.95	258.07		160.36	16.20	222.22		138.08
14.00	257.14		159.78	16.25	221.54		137.66
14.05	256.23		159.21	16.30	220.86		137.24
14.10	255.32		158.65	16.35	220.18		136.81
14.15	254.42		158.09	16.40	219.51		136.40
14.20	253.52		157.53	16.45	218.84		135.98
14.25	252.63		156.98	16.50	218.18		135.57
14.30	251.75		156.43	16.55	217.52		135.16
14.35	250.87		155.88	16.60	216.86		134.75
14.40	250.00		155.34	16.65	216.21		134.35
14.45	249.14		154.81	16.70	215.57		133.95
14.50	248.28		154.27	16.75	214.92		133.55
14.55	247.42		153.74	16.80	214.29		133.15
14.60	246.58		153.22	16.85	213.65		132.76
14.65	245.43		152.50	16.90	213.02		132.36
14.70	244.90		152.17	16.95	212.39		131.97
14.75	244.07		151.66	17.00	211.76		131.58
14.80	243.24		151.14	17.05	211.14		131.20
14.85	242.43		150.64	17.10	210.53		130.82
14.90	241.61		150.13	17.15	209.91		130.43
14.95	240.80		149.63	17.20	209.30		130.05
15.00	240.00		149.13	17.25	208.69		129.67
15.05	239.20		148.63	17.30	208.09		129.30
15.10	238.41		148.14	17.35	207.49		128.93
15.15	237.62		147.65	17.40	206.90		128.56
15.20	236.84		147.17	17.45	206.30		128.19
15.25	236.07		146.69	17.50	205.71		127.82
15.30	235.29		146.20	17.55	205.13		127.46
15.35	234.53		145.73	17.60	204.55		127.10
15.40	233.77		145.26	17.65	203.97		126.74
15.45	233.01		144.79	17.70	203.39		126.38
15.50	232.26		144.32	17.75	202.82		126.03
15.55	231.51		143.85	17.80	202.25		125.67
15.60	230.77		143.39	17.85	201.68		125.32
15.65	230.03		142.93	17.90	201.12		124.97
15.70	229.30		142.48	17.95	200.56		124.62
15.75	228.57		142.03	18.00	200.00		124.27
15.80	227.85		141.58	18.05	199.45		123.93
15.85	227.13		141.13	18.10	198.90		123.59
15.90	226.42		140.69	18.15	198.35		123.25

SPEED TABLE OVER KILOMETER COURSE—Continued

Time for 1 Kilom. Sec.	Equal to kilometers per hour	or Equal to miles per hour	Time for 1 Kilom. Sec.	Equal to kilometers per hour	or Equal to miles per hour
18.20	197.80	122.91	20.90	172.25	107.03
18.25	197.26	122.57	21.00	171.43	106.52
18.30	196.72	122.24	21.10	170.62	106.02
18.35	196.19	121.91	21.20	169.81	105.52
18.40	195.66	121.58	21.30	169.02	105.03
18.45	195.12	121.24	21.40	168.23	104.53
18.50	194.59	120.91	21.50	167.44	104.04
18.55	194.07	120.59	21.60	166.67	103.56
18.60	193.55	120.27	21.70	165.90	103.09
18.65	193.03	119.95	21.80	165.14	102.61
18.70	192.52	119.63	21.90	164.38	102.14
18.75	192.00	119.30	22.00	163.64	101.68
18.80	191.49	118.99	22.10	162.90	101.22
18.85	190.98	118.67	22.20	162.16	100.76
18.90	190.48	118.36	22.30	161.44	100.31
18.95	189.97	118.04	22.40	160.71	99.86
19.00	189.47	117.73	22.50	160.00	99.42
19.05	188.98	117.42	22.60	159.29	98.98
19.10	188.48	117.11	22.70	158.59	98.54
19.15	187.99	116.81	22.80	157.89	98.11
19.20	187.50	116.51	22.90	157.21	97.69
19.25	187.01	116.20	23.00	156.52	97.26
19.30	186.53	115.90	23.10	155.84	96.83
19.35	186.05	115.61	23.20	155.17	96.42
19.40	185.57	115.31	23.30	154.51	96.01
19.45	185.09	115.01	23.40	153.85	95.60
19.50	184.62	114.72	23.50	153.19	95.18
19.55	184.14	114.42	23.60	152.55	94.79
19.60	183.67	114.13	23.70	151.90	94.39
19.65	183.21	113.84	23.80	151.26	93.99
19.70	182.74	113.55	23.90	150.63	93.60
19.75	182.28	113.26	24	150.00	93.21
19.80	181.82	112.98	1-5	148.76	92.44
19.85	181.36	112.69	2-5	147.54	91.68
19.90	180.90	112.41	3-5	146.34	90.94
19.95	180.45	112.13	4-5	145.16	90.21
20.00	180.00	111.85	25	144.00	89.48
20.10	179.10	111.29	1-5	142.86	88.83
20.20	178.22	110.74	2-5	141.73	88.10
20.30	177.34	110.19	3-5	140.62	87.38
20.40	176.47	109.65	4-5	139.53	86.70
20.50	175.61	109.12	26	138.46	86.04
20.60	174.76	108.59	1-5	137.40	85.38
20.70	173.91	108.06	2-5	136.36	84.73
20.80	173.08	107.55	3-5	135.34	84.09

SPEED TABLE OVER KILOMETER COURSE—Continued

Time for 1 Kilom. Sec.	Equal to kilometers per hour	or Equal to miles per hour	Time for 1 Kilom. Sec.	Equal to kilometers per hour	or Equal to miles per hour
4-5	134.33	83.47	4-5	100.56	62.48
27	133.33	82.85	36	100.00	62.14
1-5	132.35	82.24	1-5	99.44	61.79
2-5	131.38	81.63	2-5	98.90	61.45
3-5	130.43	80.15	3-5	98.36	61.12
4-5	129.50	80.47	4-5	97.82	60.78
28	128.57	79.89	37	97.29	60.45
1-5	127.66	79.32	1-5	96.77	60.13
2-5	126.76	78.76	2-5	96.25	59.81
3-5	125.87	78.21	3-5	95.74	59.49
4-5	125.00	77.67	4-5	95.23	59.17
29	124.13	77.13	38	94.73	58.86
1-5	123.28	76.60	1-5	94.24	58.56
2-5	122.45	76.09	2-5	93.75	58.26
3-5	121.62	75.57	3-5	93.26	57.95
4-5	120.80	75.06	4-5	92.78	57.65
30	120.00	74.56	39	92.30	57.35
1-5	119.20	74.06	1-5	91.83	57.06
2-5	118.42	73.58	2-5	91.37	56.78
3-5	117.64	73.09	3-5	90.91	56.49
4-5	116.88	72.62	4-5	90.45	56.20
31	116.13	72.16	40	90.00	55.92
1-5	115.38	71.69	1-5	89.55	55.64
2-5	114.65	71.24	2-5	89.11	55.36
3-5	113.90	70.77	3-5	88.67	55.09
4-5	113.21	70.34	4-5	88.23	54.82
32	112.50	69.90	41	87.80	54.56
1-5	111.80	69.47	1-5	87.38	54.30
2-5	111.11	69.04	2-5	86.95	54.02
3-5	110.43	68.61	3-5	86.53	53.76
4-5	109.75	68.19	4-5	86.12	53.51
33	109.09	67.79	42	85.71	53.26
1-5	108.43	67.37	1-5	85.30	53.00
2-5	107.78	66.97	2-5	84.90	52.75
3-5	107.14	66.57	3-5	84.50	52.50
4-5	106.51	66.18	4-5	84.11	52.26
34	105.88	65.79	43	83.72	52.02
1-5	105.26	65.40	1-5	83.33	51.78
2-5	104.65	65.02	2-5	82.95	51.54
3-5	104.04	64.65	3-5	82.57	51.30
4-5	103.45	64.28	4-5	82.19	51.07
35	102.85	63.91	44	81.81	50.83
1-5	102.27	63.55	1-5	81.44	50.60
2-5	101.69	63.19	2-5	81.08	50.38
3-5	101.12	62.83	3-5	80.71	50.15

SPEED TABLE OVER KILOMETER COURSE—Continued

Time for 1 Kilom. Sec.	Equal to kilometers per hour	or	Equal to miles per hour	Time for 1 Kilom. Sec.	Equal to kilometers per hour	or	Equal to miles per hour
4-5	80.35		49.92	2-5	68.70		42.69
45	80.00		49.71	3-5	68.44		4.532
1-5	79.64		49.48	4-5	68.18		42.37
2-5	79.29		49.27	53	67.92		42.21
3-5	78.94		49.05	1-5	67.66		42.04
4-5	78.60		48.84	2-5	67.41		41.89
46	78.26		48.63	3-5	67.16		41.73
1-5	77.92		48.42	4-5	66.91		41.62
2-5	77.58		48.20	54	66.66		41.38
3-5	77.25		48.00	1-5	66.42		41.23
4-5	76.92		47.79	2-5	66.17		41.07
47	76.59		47.59	3-5	65.93		40.93
1-5	76.27		47.39	4-5	65.69		40.77
2-5	75.95		47.19	55	65.45		40.67
3-5	75.63		46.99	1-5	65.21		40.52
4-5	75.31		46.79	2-5	64.98		40.38
48	75.00		46.60	3-5	64.74		40.23
1-5	74.68		46.40	4-5	64.51		40.09
2-5	74.38		46.22	56	64.28		39.95
3-5	74.07		46.03	1-5	64.05		39.80
4-5	73.77		45.84	2-5	63.83		39.67
49	73.47		45.65	3-5	63.60		39.52
1-5	73.17		45.47	4-5	63.38		39.39
2-5	72.87		45.28	57	63.16		39.25
3-5	72.58		45.10	1-5	62.93		39.11
4-5	72.29		44.92	2-5	62.71		38.97
50	72.00		44.74	3-5	62.50		38.84
1-5	71.71		44.56	4-5	62.28		38.70
2-5	71.42		44.38	58	62.07		38.57
3-5	71.14		44.21	1-5	61.85		38.44
4-5	70.86		44.06	2-5	61.64		38.31
51	70.58		43.83	3-5	61.43		38.18
1-5	70.31		43.69	4-5	61.22		38.04
2-5	70.04		43.52	59	61.01		37.91
3-5	69.76		43.35	1-5	60.81		37.79
4-5	69.49		43.18	2-5	60.60		37.66
52	69.23		43.02	3-5	60.40		37.54
1-5	68.96		42.85	4-5	60.20		37.41

CHAPTER V

AERO CLUB OF AMERICA REFERENCE TABLES WEIGHTS OF LIQUIDS

As given by United States Air Service Hand Book.

- *1 U. S. Gallon (231 cu. in.) Gasoline—
 Max. 6.0 lbs. @ standard temp. 62° F.
 Min. 5.83 lbs. @ standard temp. 62° F.
 Av. 5.915 lbs. @ standard temp. 62° F.
- *1 U. S. Gallon (231 cu. in.) Castor Oil—
 8.012 lbs. @ standard temp. 62° F.
- *1 U. S. Gallon (231 cu. in.) Mineral Oil—
 7.528 lbs. @ standard temp. 62° F.
- 1 U. S. Gallon (231 cu. in.) Water (fresh)—
 8.336 lbs. @ standard temp. 62° F.

*For approximate reference only.

BAUMÉ HYDROMETER AND SPECIFIC GRAVITY EQUIVALENTS

For liquids lighter than water (gasoline and other engine fuels), the Baumé scale is based on the formula:

$$\text{Specific gravity (at 60° F.)} = \frac{140}{130 + \text{Bé}} \quad \text{or} \quad \text{Baumé} = \frac{140}{\text{Sp.Gr.}} - 130$$

The scale is as follows:

Baumé	Specific Gravity	Lbs. in Gal.	Baumé	Specific Gravity	Lbs. in Gal.
10	1.000	8.33	22	0.9210	7.68
11	0.9929	8.27	23	0.9150	7.63
12	0.9859	8.21	24	0.9090	7.58
13	0.9790	8.16	25	0.9032	7.54
14	0.9722	8.10	26	0.8974	7.49
15	0.9655	8.05	27	0.8917	7.44
16	0.9589	7.99	28	0.8860	7.39
17	0.9523	7.94	29	0.8805	7.34
18	0.9459	7.88	30	0.8750	7.29
19	0.9395	7.83	31	0.8695	7.25
20	0.9333	7.78	32	0.8641	7.21
21	0.9271	7.73	33	0.8588	7.16

BAUMÉ HYDROMETER AND SPECIFIC GRAVITY EQUIVALENTS—Continued

Baumé	Specific Gravity	Lbs. in Gal.	Baumé	Specific Gravity	Lbs. in Gal.
34	0.8536	7.12	63	0.7253	6.07
35	0.8484	7.07	64	0.7216	6.03
36	0.8433	7.03	65	0.7179	6.00
37	0.8383	6.99	66	0.7142	5.97
38	0.8333	6.95	67	0.7106	5.94
39	0.8284	6.91	68	0.7070	5.91
40	0.8235	6.87	69	0.7035	5.88
41	0.8187	6.83	70	0.7000	5.85
42	0.8139	6.80	71	0.6965	5.82
43	0.8092	6.76	72	0.6930	5.79
44	0.8045	6.72	73	0.6896	5.77
45	0.8000	6.68	74	0.6863	5.74
46	0.7954	6.64	75	0.6829	5.71
47	0.7909	6.60	76	0.6796	5.68
48	0.7865	6.57	77	0.6763	5.65
49	0.7821	6.53	78	0.6730	5.63
50	0.7777	6.49	79	0.6698	5.60
51	0.7734	6.46	80	0.6666	5.57
52	0.7692	6.42	81	0.6635	5.55
53	0.7650	6.39	82	0.6604	5.51
54	0.7608	6.36	83	0.6573	5.48
55	0.7567	6.32	84	0.6542	5.45
56	0.7526	6.29	85	0.6511	5.42
57	0.7486	6.26	86	0.6481	5.40
58	0.7446	6.22	87	0.6451	5.38
59	0.7407	6.19	88	0.6422	5.36
60	0.7368	6.16	89	0.6392	5.33
61	0.7329	6.13	90	0.6363	5.30
62	0.7290	6.10			

TABLE 2—LENGTH EQUIVALENTS

Units	Inches	Feet	Yards	Fathoms	Statute miles
1 inch.....	1	.0833	.0278	.0139	.01578
1 foot.....	12	1	.333	.1667	.1894
1 yard.....	36	3	1	.50	.5682
1 fathom.....	72	6	2	1	1.136
1 mile.....	63,360	5,280	1,760	880	1
1 nautical mile.....	72,962	6,080.2	2,026.7	1,013.4	1.1516
1 centimeter.....	.3937	.03281	.01094	.01668	.0006214
1 meter.....	39.370	3.281	1.0936	1.646	.0006214
1 kilometer.....	39,370	3,281	1,093.6	1,646	.6214
1 league.....	218,886	18,240.9	6,080.3	3,040.1	3.4547

TABLE 2—LENGTH EQUIVALENTS—Continued

Units	Nautical miles	Centi-meters	Meters	Kilo-meters	Leagues
1 inch.....	.1370	2.540	.0254	.1254	.14567
1 foot.....	.1645	30.480	.30480	.3048	.1548
1 yard.....	.4933	91.440	.9144	.9144	.1644
1 fathom.....	.9868	182.88	1.8288	.1829	.329
1 mile.....	.8683	160.934	1.609.35	1.60935	.2894
1 nautical mile.....	1	185.325	1.853.25	1.85325	.333
1 centimeter.....	.5396	1	.01	.1	.1799
1 meter.....	.5396	1	1	.1	.1799
1 kilometer.....	.53459	1	1	1	.1799
1 league.....	3	555.975	555.975	5.55975	1

TABLE 3—AREA EQUIVALENTS

Units	Square inches	Square feet	Square yards	Acres	Square miles	Square meters	Hectares
1 square inch....	1	.6944	.7716	.1594	.249	.6452	.6454
1 square foot....	144	1	.1111	.2296	.73587	.09290	.9290
1 square yard....	1,296	9	1	.2066	.3228	.8361	.8361
1 acre.....	6,272.640	43,560	4,840	1	.1563	4,046.87	.4047
1 square mile.....	278,784	309,763	640	1	25.9999	259	259
1 square meter....	1,550	10.764	1.196	.24711	.3861	1	.107
1 hectare.....	155	1076.4	.11960	2.4711	.3861	1	1

TABLE 4—VOLUME EQUIVALENTS

Units	Cubic inches	Cubic feet	Cubic yards	Cubic centimeters	Cubic meters
1 cubic inch.....	1	.5787	.2143	16.39	.1638
1 cubic foot.....	1,728	1	.03704	28.317	.02832
1 cubic yard.....	46,656	27	1	764,559	.7645
1 cubic centimeter.....	.06102	.3531	.1307	1	.1
1 cubic meter.....	61.023	35.314	1.3079	1	1

TABLE 5—CAPACITY EQUIVALENTS

Units	Cubic inches	Fluid ounces	Gills	Liquid pints	Liquid quarts	Gallons (U. S.)	Gallons (Imperial)	Liters
1 cubic inch....	1	.5541	.1385	.03464	.01732	.14329	.136046	.01639
1 fluid ounce....	1.8047	1	.25	.0625	.03125	.7813	.6606	.02957
1 gill.....	7.2188	4	1	.25	.125	.03125	.2602	.118292
1 liquid pint....	28.875	16	4	1	.5	.125	.10408	.473167
1 liquid quart....	57.75	32	8	2	1	.25	.20822	.9463
1 gallon (U. S.)	231	128	32	8	4	1	.83265	3.785
1 gallon (Imperial)...	277.41	153.718	38.429	9.607	4.804	1.201	1	4.5460
1 liter.....	61.023	33.814	8.453	2.113	1.0567	.2642	.21998	1

TABLE 6—MASS OR WEIGHT EQUIVALENTS

Units	Kilograms	Grains	Ounces	
			Troy	Avoirdupois
1 kilogram.....	1	15,432	32.151	35.273
1 grain.....	.16480	1	.2083	.02286
1 ounce (troy).....	.0311	480	1	.10971
1 ounce (avoirdupois).....	.02835	437.5	.9115	1
1 pound (troy).....	.3732	5,760	12	13.17
1 pound (avoirdupois).....	.4536	7 $\frac{1}{2}$	14.583	16
1 ton, short.....	907.18	14 $\frac{1}{2}$	29.167	32 $\frac{1}{2}$
1 ton, long.....	1,016	15,683	32 $\frac{1}{2}$	35.840
1 ton, metric.....	1 $\frac{1}{2}$	15,432.356	32.151	35.274

Units	Pounds		Tons		
	Troy	Avoirdupois	Short	Long	Metric
1 kilogram.....	2.6792	2.2046	.71102	.9842	.71
1 grain.....	.1736	.1429	.7143	.6378	.76480
1 ounce (troy).....	.08333	.06857	.3429	.3061	.3110
1 ounce (avoirdupois).....	.07595	.0625	.3125	.2790	.02835
1 pound (troy).....	1	.8229	.04114	.02673	.03732
1 pound (avoirdupois).....	1.2152	1	.85	.4464	.4536
1 ton, short.....	2.431	2 $\frac{1}{2}$	1	.9829	.9072
1 ton, long.....	2.722	2.240	1.12	1	1.016
1 ton, metric.....	2.679	2.205	1.102	.9842	1

MASS UNITS USED BY ENGINEERS

A.—English systems:

Unit of mass = g pounds, where g is the acceleration due to gravity.

Hence, on foot-second system, unit of mass = 32.14 pounds; give it arbitrary symbol U..

Hence, on mile-hour system, unit of mass = 78,900 pounds; give it arbitrary symbol U..

B.—French systems:

Unit of mass = g kilograms.

Hence, on meter-second system, unit of mass = 9.80 kilograms; give it arbitrary symbol U..

Hence, on kilometer-hour system, unit of mass = 127,000 kilograms; give it arbitrary symbol U..

TABLE 7—DENSITY EQUIVALENTS

Units	Grams per cubic centimeter	Pounds per cubic inch	Pounds per cubic foot	Kilograms per cubic meter	Pounds per United States gal.	Pounds per British gallon
1 gram per cubic centimeter.....	1	.03613	62.43	1 $\frac{1}{2}$	8.345	10.022
1 pound per cubic in.....	27.68	1	1,728	277.02	231	277.431
1 pound per cubic foot.....	.01602	.035787	1	16.02	.1337	.1606
1 kilogram per cubic meter.....	.00998	.03612	.06243	1	.8345	.010
1 pound per U. S. gal.....	.1198	.04329	7.481	119.845	1	.8328
1 pound per British gallon.....	.0998	.03604	6.2266	1 $\frac{1}{2}$	1.201	1

TABLE 7—DENSITY EQUIVALENTS—Continued

USING ENGINEERING UNITS OF MASS

$$1 \frac{\text{lb.}}{\text{ft.}^3} = 0.0311 \frac{\text{U}_1}{\text{ft.}^3}; 1 \frac{\text{U}_1}{\text{ft.}^3} = 32.14 \frac{\text{lb.}}{\text{ft.}^3}$$

$$1 \frac{\text{kg.}}{\text{m.}^3} = 0.0120 \frac{\text{U}_2}{\text{m.}^3}; 1 \frac{\text{U}_2}{\text{m.}^3} = 9.80 \frac{\text{kg.}}{\text{m.}^3}$$

TABLE 8—LINEAR VELOCITY EQUIVALENTS

Units	Centi- meters per second	Meters per second	Meters per minute	Kilo- meters per hour	Feet per second	Feet per minute	Miles per hour	Knots
1 centimeter per second.....	1	.01	.6	.036	.03281	1.9685	.02237	.01942
1 meter per sec.....	100	1	60	3.6	3.281	196.85	2.237	1.942
1 meter per min.....	1.667	.01667	1	.06	.05468	3.281	.03728	.03237
1 kilometer per hour.....	27.78	.2778	16.67	1	.9113	54.68	.6214	.53960
1 ft. per sec.....	30.48	.3048	18.29	1.097	1	60	.6818	.59209
1 ft. per min.....	.5080	.0508	.3048	.01829	.01667	1	.01136	.00987
1 mile per hour.....	44.70	.4470	26.82	1.609	1.467	88	1	.86839
1 knot.....	51.497	.51497	30.898	1.8532	1.68894	101.337	1.15155	1

TABLE 9—ANGULAR VELOCITY EQUIVALENTS

Units	Degrees per second	Grades per second	Radians per second	Revolutions per second	Degrees per minute	Grades per minute	Radians per minute	Revolutions per minute
1 degree per sec.....	1	1.111	.01745	.02778	60	54	3.438	216
1 grade per sec.....	.90	1	.01571	.025	66.667	60	3.820	24
1 radian per sec.....	57.30	63.67	1	.1592	1.047	.9425	60	376.9
1 revolution per second.....	360	4	6.283	1	.1667	.15	9.551	60
1 degree per minute.....	.01667	.01852	.02909	.04630	1	.90	57.30	360
1 grade per min.....	.0150	.01667	.02618	.04167	1.111	1	63.67	4
1 radian per minute.....	.9549	1.061	.01667	.02653	.01745	.01571	1	6.283
1 revolution per minute.....	6.0	6.667	.1047	.01667	.02778	.025	.1592	1

NOTE—One circumference of a circle = 400 grades.

TABLE 10—LINEAR ACCELERATION EQUIVALENTS

Units	Feet per second ²	Miles per hour per second	Miles per second ²	Kilometers per hour per second	Standard gravity, g
1 foot per second ²	1	.6818	.3048	1.097	.03108
1 mile per hour per second.....	1.467	1	.4470	1.609	.03624
1 mile per second ²	3.281	2.237	1	3.600	.1020
1 kilogram per hour per second.....	.9114	.6214	.2778	1	.0283
Standard gravity, g.....	32.174	21.936	9.8067	35.30	

TABLE 11—FORCE EQUIVALENTS

Units	Pound weight, avoirdupois	Hundred-weight, (CWT.)	Poundal	Grain, weight
1 pound weight, avoirdupois.....	1	.01	32.174	7 $\frac{7}{8}$
1 hundred weight.....	1 $\frac{1}{2}$	1	3,217.4	7 $\frac{7}{8}$
1 poundal.....	.03108	. $\frac{1}{3}$ 3108	1	217.591
1 grain, weight.....	. $\frac{1}{7}$ 1429	. $\frac{1}{7}$ 1429	. $\frac{1}{7}$ 4595	1
1 gram, weight.....	. $\frac{1}{7}$ 2204	. $\frac{1}{7}$ 2204	.07093	15.43
1 short ton.....	2 $\frac{1}{2}$	20	64,348	14 $\frac{1}{2}$
1 long ton.....	2,240	22.4	72,074.4	1568 $\frac{1}{2}$
1 dyne.....	. $\frac{1}{7}$ 2248	. $\frac{1}{7}$ 2248	. $\frac{1}{7}$ 7233	.01574
1 megadyne.....	2.248	.0225	72.33	15,740

Units	Gram, weight	Short ton, weight	Long ton, weight	Dyne	Mega-dyne
1 pound weight, avoirdupois.....	453.6	. $\frac{1}{2}$ 50	. $\frac{1}{2}$ 4464	4448 $\frac{1}{2}$	.4448
1 hundred weight.....	45,360	.05	.0446	4448 $\frac{1}{2}$	44.48
1 poundal.....	14.10	. $\frac{1}{7}$ 1554	. $\frac{1}{7}$ 1388	13,825	.0138
1 grain, weight.....	.0648	. $\frac{1}{7}$ 714	. $\frac{1}{7}$ 6377	63.54	. $\frac{1}{7}$ 6354
1 gram, weight.....	1	. $\frac{1}{7}$ 1102	. $\frac{1}{7}$ 9841	980.6	. $\frac{1}{7}$ 9806
1 short ton.....	9072 $\frac{1}{2}$	1	.8928	8896 $\frac{1}{2}$	889.6
1 long ton.....	1016 $\frac{1}{2}$	1.12	1	9964 $\frac{1}{2}$	996.4
1 dyne.....	. $\frac{1}{7}$ 102	. $\frac{1}{7}$ 1124	. $\frac{1}{7}$ 1004	1	. $\frac{1}{7}$ 1
1 megadyne.....	1,020	. $\frac{1}{7}$ 1124	. $\frac{1}{7}$ 1004	1 $\frac{1}{2}$	1

TABLE 12—WORK OR ENERGY EQUIVALENTS

Units	Joules = 1 $\frac{1}{2}$ ergs	Kilogram meters	Foot-pounds	Kilowatt hours
1 joule.....	1	.10197	.7376	. $\frac{1}{7}$ 2778
1 kilogram meter.....	9.80665	1	7.233	. $\frac{1}{7}$ 2724
1 foot-pound.....	1.356	.1383	1	. $\frac{1}{7}$ 3766
1 kilowatt hour.....	36 $\frac{1}{2}$	3671 $\frac{1}{2}$	2655 $\frac{1}{2}$	1
1 cheval vapeur hour.....	2648 $\frac{1}{2}$	27 $\frac{1}{2}$	19529 $\frac{1}{2}$	.7355
1 horsepower hour.....	26845 $\frac{1}{2}$	273,750	198 $\frac{1}{2}$	.7457
1 calorie.....	4.183	.4266	3.086	. $\frac{1}{7}$ 1162
1 kilogram calorie.....	4.183	426.6	3.086	. $\frac{1}{7}$ 1162
1 British thermal unit.....	1.054	107.5	777.52	. $\frac{1}{7}$ 2928

Units	Cheval vapeur hours	Horse-power hours	Calories	Kilogram calories	British thermal units
1 joule.....	. $\frac{1}{7}$ 3777	. $\frac{1}{7}$ 3725	.2390	. $\frac{1}{7}$ 2390	. $\frac{1}{7}$ 9486
1 kilogram meter.....	. $\frac{1}{7}$ 37037	. $\frac{1}{7}$ 3653	2.344	. $\frac{1}{7}$ 2344	. $\frac{1}{7}$ 930
1 foot-pound.....	. $\frac{1}{7}$ 51206	. $\frac{1}{7}$ 50505	.3240	. $\frac{1}{7}$ 3241	. $\frac{1}{7}$ 128
1 kilowatt hour.....	1.3596	1.341	8605 $\frac{1}{2}$	860.5	3.415
1 cheval vapeur hour.....	1	.9863	6329 $\frac{1}{2}$	632.9	2.512
1 horsepower hour.....	1.0139	1	6417 $\frac{1}{2}$	641.7	2.547
1 calorie.....	. $\frac{1}{7}$ 158	. $\frac{1}{7}$ 1558	1	. $\frac{1}{7}$ 1	. $\frac{1}{7}$ 3968
1 kilogram calorie.....	. $\frac{1}{7}$ 158	. $\frac{1}{7}$ 1558	1 $\frac{1}{2}$	1	3.968
1 British thermal unit.....	. $\frac{1}{7}$ 3981	. $\frac{1}{7}$ 3927	252.2	.252	1

TABLE 13—POWER EQUIVALENTS

Units	Horse-power	Kilo-watts	Cheval vapeur metric horse-power	Meter kilograms per second	Foot-pounds per second	Kilogram calories per second	British thermal units per second
1 horsepower	1	.7457	1.014	76.04	550	.1783	.7074
1 kilowatt	1.341	1	1.360	102.0	737.6	.2390	.9486
1 cheval vapeur metric h. p. . . .	.9863	.7355	1	75	542.3	.1758	.6977
1 meter kilogram per second . . . .	.01315	.09807	.01333	1	7.233	.12344	.09303
1 foot pound per second . . . . .	.00182	.01356	.01184	.1383	1	.03241	.01286
1 kilogram calorie per second	5.610	4.183	5.688	426.6	3.086	1	3.968
1 British thermal unit per second	1.414	1.054	1.433	107.5	777.5	.2520	1

TABLE 14—PRESSURE EQUIVALENTS

Units	Megabars or megadynes per square centimeter	Kilograms per square centimeter	Kilograms per square meter	Pounds per square inch
1 megabar (= 18 dynes per square centimeter)	1	1.0197	10,197	14.50
1 kilogram per square centimeter . . . . .	.9807	1	10	14.22
1 kilogram per square meter . . . . .	.0009807	.01	1	.01422
1 pound per square inch . . . . .	.06895	.07031	703.1	1
1 pound per square foot . . . . .	.04788	.04883	4.882	.1694
1 long ton per square inch		157.5	1575	
1 long ton per square foot				
1 short ton per square inch	366.97	140.632	1,406.320	13.89
1 short ton per square foot . . . . .	.9576	.9765	9.765	14.70
1 atmosphere	1.0133	1.0333	10.333	19.34
Mercury { 1 meter	1.333	1.3596	13.596	19.34
{ 1 inch . . . . .	.03386	.03453	345.3	.4912
Water { 1 meter . . . . .	.09798	.09991	999.1	1.421
{ 1 inch . . . . .	.02489	.02538	25.4	.03613
{ 1 foot . . . . .	.02986	.03045	304.5	.4332

Units	Pounds per square foot	Long tons per square inch	Long tons per square foot	Short tons per square inch	Short tons per square foot
1 megabar (= 18 dynes per square centimeter)	2.088			.0725	1.044
1 kilogram per square centimeter	2.047.6	.0348		.0711	1.024
1 kilogram per square meter . . . . .	.2048	.0348		.0711	.1024
1 pound per square inch	144			.05	.072
1 pound per square foot	1			.03472	.05
1 long ton per square inch		1			
1 long ton per square foot			1		
1 short ton per square inch				1	
1 short ton per square foot	2,000.16				1
1 atmosphere	2,116.8				1.058
Mercury { 1 meter	2,784.9				1.392
{ 1 inch	70.732				.03536
Water { 1 meter	204.62				.1023
{ 1 inch	5.204				.02599
{ 1 foot	62.380				.03119

TABLE 14—PRESSURE EQUIVALENTS—Continued

Units	Atmospheres	Columns of mercury at 15° C.		Columns of water at 15° C.		
		Meters	Inches	Meters	Inches	Feet
1 megabar (= 18 dynes per sq. centimeter)	.9869	.753	29.53	10.21	401.8	33.48
1 kilogram per square centimeter	.9678	.7355	28.96	10.01	394	32.84
1 kilogram per square meter	.9678	.735	28.96	1.001	.03937	.3284
1 pound per square in.	.06804	.05171	2.036	.7037	27.70	2.309
1 pound per square ft.	.34725	.3591	14.14	3.4887	139.22	11.602
1 short ton per sq. ft.	.9450	.7182	28.28	9.773	384.8	32.06
1 atmosphere	1	.76	29.92	10.34	407.2	33.93
Mercury { 1 meter		1	39.37	13.61	535.7	44.64
{ 1 inch		.0254	1	.3456	13.61	1.134
Water { 1 meter		.07349	2.893	1	39.37	3.281
{ 1 inch		.31868	12.749	.02540	1	.08333
{ 1 foot		.02240	.8819	.3048	12	1

TABLE 15—COUPLE EQUIVALENTS

Units	Kilogram-meters	Pound-feet
1 kilogram-meter	1	7.233
1 pound-foot	.1383	1

TABLE 16—TORQUE EQUIVALENTS

Units	Pound-foot	Gram-foot	Dyne-foot
1 pound-foot	1	13,810	13564
1 gram-foot	.37253	1	980.665
1 dyne-foot	.37375	.3102	1

TABLE 17—LOADING EQUIVALENTS

Units	Pound per square foot	Pound per English horsepower	Kilogram per square meter	Kilogram per metric horsepower
1 pound per square foot	1		4.882	
1 pound per English horsepower		1		0.459
1 kilogram per square meter	0.2048		1	
1 kilogram per metric horsepower		2.1726		1

TABLE 18—AERODYNAMIC EQUIVALENTS

Units	Pounds per square foot per mile per hour	Pounds per square foot per foot per second	Kilograms per square meter per kilometer per hour	Kilograms per square meter per meter per second
Pound per square ft. per mile per hr.	.....	.4649	1.995	24.5
Pound per square ft. per ft. per sec.	2.1510	.....	4.070	52.5
Kilograms per square meter per km. per hour.....	.5304	.2466	.....	.....
Kilograms per square meter per meter per second.....	.04092	.01903	.....	.....
Absolute units.....	.0251	.02237	.....	.....

TABLE 19—INCLINATION EQUIVALENTS

Rise	Angle of Inclination	Tangent	Sine	Radians
	° ' "			
1 in 30.....	1 55	0.0333	0.0333	0.0333
1 in 25.....	2 17	.0400	.0400	.0400
1 in 20.....	2 52	.0500	.0500	.0500
1 in 18.....	3 11	.0555	.0554	.0555
1 in 16.....	3 35	.0625	.0624	.0625
1 in 14.....	4 5	.0714	.0712	.0713
1 in 12.....	4 46	.0833	.0831	.0832
1 in 10.....	5 43	.1000	.0996	.0997
1 in 9.....	6 21	.1111	.1103	.1105
1 in 8.....	7 8	.1250	.1242	.1245
1 in 7.....	8 8	.1429	.1415	.1419
1 in 6.....	9 28	.1667	.1645	.1652
1 in 5.....	11 19	.2000	.1962	.1975
1 in 4.....	14 2	.2000	.2425	.2449
1 in 3.....	18 26	.3333	.3162	.3217

TABLE 20—TEMPERATURE CONVERSION

Conversion of degrees Fahrenheit.

Centigrade and degrees absolute.

°F	°C	°A	°F	°C	°A
-50	-45.6	227.4	-42	-41.1	231.9
-49	-45	228.	-41	-40.6	232.4
-48	-44.5	228.5			
-47	-43.8	229.2	-40	-40.	233.
-46	-43.4	229.6	-39	-39.4	233.6
			-38	-38.9	234.1
-45	-42.7	230.3	-37	-38.3	234.7
-44	-42.2	230.8	-36	-37.8	235.2
-43	-41.7	231.3			

TEMPERATURE CONVERSION TABLE—Continued

°F	°C	°A	°F	°C	°A
-35	-37.2	235.8	3	-16.1	256.9
-34	-36.7	236.3	4	-15.6	257.4
-33	-36.1	236.9			
-32	-35.6	237.4	+ 5	-15.	258.
-31	-35.	238.	6	-14.4	258.6
			7	-13.9	259.1
-30	-34.4	238.6	8	-13.3	259.7
-29	-33.9	239.1	9	-12.8	260.2
-28	-33.3	239.7			
-27	-32.8	240.2	+10	-12.2	260.8
-26	-32.2	240.8	11	-11.7	261.3
			12	-11.1	261.9
			13	-10.6	262.4
-25	-31.7	241.3	14	-10.	263.
-24	-31.1	241.9			
-23	-30.6	242.4	+15	- 9.4	263.6
-22	-30.	243.	16	- 8.9	264.1
-21	-29.4	243.6	17	- 8.3	264.7
			18	- 7.8	265.2
-20	-28.9	244.1	19	- 7.2	265.8
-19	-28.3	244.7			
-18	-27.8	245.2	20	- 6.7	266.3
-17	-27.2	245.8	21	- 6.1	266.9
-16	-26.7	246.3	22	- 5.6	267.4
			23	- 5.0	268.0
-15	-26.1	246.9	24	- 4.4	268.6
-14	-25.6	247.4			
-13	-25.	248.	25	- 3.9	269.1
-12	-24.4	248.6	26	- 3.3	269.7
-11	-23.9	249.1	27	- 2.8	270.2
			28	- 2.2	270.8
-10	-23.3	249.7	29	- 1.7	271.3
- 9	-22.8	250.2			
- 8	-22.2	250.8	30	- 1.1	271.9
- 7	-21.7	251.3	31	- .6	272.4
- 6	-21.1	251.9	32	.0	273.0
			33	+ .6	273.6
- 5	-20.6	252.4	34	1.1	274.1
- 4	-20.	253.			
- 3	-19.4	253.6	35	1.7	274.7
- 2	-18.9	254.1	36	2.2	275.2
- 1	-18.3	254.7	37	2.8	275.8
			38	3.3	276.3
0	-17.8	255.2	39	3.9	276.9
+ 1	-17.2	255.8			
2	-16.7	256.3	40	4.4	277.4

TEMPERATURE CONVERSION TABLE—Continued

°F	°C	°A	°F	°C	°A
41	5.0	278.0	80	26.7	299.7
42	5.6	278.6	81	27.2	300.2
43	6.1	279.1	82	27.8	300.8
44	6.7	279.7	83	28.3	301.3
45	7.2	280.2	84	28.9	301.9
46	7.8	280.8	85	29.4	302.4
47	8.3	281.3	86	30.0	303.0
48	8.9	281.9	87	30.6	303.6
49	9.4	282.4	88	31.1	304.1
50	10.0	283.0	89	31.7	304.7
51	10.6	283.6	90	32.2	305.2
52	11.1	284.1	91	32.8	305.8
53	11.7	284.7	92	33.3	306.3
54	12.2	285.2	93	33.9	306.9
55	12.8	285.8	94	34.4	307.4
56	13.3	286.3	95	35.0	308.0
57	13.9	286.9	96	35.6	308.6
58	14.4	287.4	97	36.1	309.1
59	15.0	288.0	98	36.7	309.7
60	15.6	288.6	99	37.2	310.2
61	16.1	289.1	100	37.8	310.8
62	16.7	289.7	101	38.3	311.3
63	17.2	290.2	102	38.9	311.9
64	17.8	290.8	103	39.4	312.4
65	18.3	291.3	104	40.0	313.0
66	18.9	291.9	105	40.6	313.6
67	19.4	292.4	106	41.1	314.1
68	20.0	293.0	107	41.7	314.7
69	20.6	293.6	108	42.2	315.2
70	21.1	294.1	109	42.8	315.8
71	21.7	294.7	110	43.3	316.3
72	22.2	295.2	111	43.9	316.9
73	22.8	295.8	112	44.4	317.4
74	23.3	296.3	113	45.0	318.0
75	23.9	296.9	114	45.6	318.6
76	24.4	297.4	115	46.1	319.1
77	25.0	298.0	116	46.7	319.7
78	25.6	298.6	117	47.2	320.2
79	26.1	299.1	118	47.8	320.8
			119	48.3	321.3

In order to convert degrees Fahrenheit (F.) into degrees Centigrade (C) subtract 32, multiply the remainder by 5 and divide by 9.

To turn Centigrade into Fahrenheit, multiply the number of deg. C. by 9, divide by 5 and add 32.

CHAPTER VI

AIRCRAFT TECHNICAL NOTE NO. 172

The Lift of Gases

In aeronautics the *lift* of a gas is always the buoyancy of a given volume of the gas in air. This buoyancy is the difference between the weight of the gas and the weight of the air displaced, that is

$$A = a_0 - b_0 \quad (1)$$

where A = buoyancy of 1 cu. ft. of gas
 a_0 = weight of 1 cu. ft. of air
 b_0 = weight of 1 cu. ft. of gas

The density of any gas varies with gravity, humidity, pressure and temperature. The variations of gravity with latitude and altitude are so small as to be negligible in all practical work. The maximum variation of density due to humidity will be less than 3 per cent for hydrogen in the worst case. The effect of moisture, when present in the usual amounts, is to reduce the lift by about 1 per cent. This correction may also be neglected. In those cases where it is necessary to use exact data, reference should be made to some good meteorological tables.

Law of Perfect Gases

It is assumed that all gases in common use will follow the perfect gas law.

$$PV = RT$$

where P = pressure—lbs. per sq. ft.
 V = volume of one lb. of gas.
 T = absolute temperature - °F
 R = Gas constant

Values of R are given in Table I.

Variation of Temperature and Pressure with Altitude

The variation of temperature with altitude is not constant at any given place or time. It was formerly assumed that the average rate of temperature decrease with altitude increase was 1° F. per 365 ft. Recent data show this to hold true for altitudes up to 10,000 ft., but between 10,000-25,000 feet the variation is 1° F. per 260 ft. An average figure may be taken at 1° F. per 300 ft. The probable temperature difference, °F., between two points separated by a vertical distance, h ft. is therefore:

$$t_0 - t_h = .0033h \quad (3)$$

The variation of pressure with altitude may be found from the modified Halley formula:

$$h = 60,350 \left(1 - \frac{(t_m - 32)}{492} \right) \log_{10} \frac{P_o}{P} \quad (4)$$

where h = altitude, ft.

P_o = pressure—ground

P = pressure—at altitude h

t_m = mean temperature of air column, °F

t_m may be found from equation (3)

Density of Gases

Given the density of a gas at any temperature and pressure to find the density at any other temperature and pressure, use equation (2), which becomes

$$\frac{P_o}{D_o T_o} = \frac{P}{DT}$$

$$\text{or } D = \frac{D_o}{P_o} \cdot P \cdot \frac{T_o}{T} \quad (2a)$$

If the original density is given in lbs. cu. ft. under standard conditions, that is, at a temperature of 32° F. and a pressure of 29.92 inches of mercury, equation (2a) will become

$$D = \frac{D_o T}{29.92} \left(\frac{1}{1 - 0.00203 (t - 32)} \right) \quad (2b)$$

Where D is the density at a temperature t °F., and a pressure of P inches of mercury. Standard densities are given in Table I.

Lift of Gases

Equation (1) when written out in full becomes

$$A = a_o (1 - .00203 (t_1 - 32)) \frac{P_1}{P_o} - b_o (1 - .00203 (T_2 - 32)) \frac{P_2}{P_o} \quad (1a)$$

The subscripts 1 and 2 referring to air and gas respectively. This equation may be used for all general cases, since it allows the temperature and pressure of the gas to differ from those of the air. In most cases, however, the temperatures and pressures will be the same for gas and air, and the gas will not be pure. The purity of a gas is, or should be, expressed so that the lift is directly proportional to the purity, for example, a gas of 90 per cent purity would have 90 per cent of the lift of gas of 100 per cent purity.

The lifts of pure dry Hydrogen and Helium in dry air have been calculated for a number of pressures and temperatures and are given in Tables 2 and 3. These data are also given Figures 1, 2 and 3. The method of finding lift for any given set of conditions is indicated on each figure by the means of arrows on the dotted lines.

Variation of Lift with Altitude

The variation of lift with altitude is given by the curve of Figure 4. This curve may also be used to find the ballonnet volume required in order that a given altitude may be attained without loss of gas.

NOTE: Refer to N.A.C. Technical Note No. 172 for complete text.

TABLE I. GAS DATA.

Gas	Specific Weight	Density Lbs. Ft. ³ ρ	Specific Volume $\frac{1}{\rho}$	Gas Constant R	C_p	C_v	K	Lift of Pure Gas Lbs. Per 1000 Cu. Ft.
Air.....	1.0000	.08071	12.39	53.338	.2373	.1687	1.407	.....
Acetylene.....	0.920	.07425	13.47	59.37	.....	.....	.....	6.48
Ammonia.....	0.597	.04818	20.76	89.34	.5202	.4068	1.277	32.53
Argon.....	1.359	.10968	9.12	38.70	.2489	.1493	1.667	.....
Carbon Diox....	1.5291	.12341	8.10	35.11	.1886	.1434	1.315	.....
Carbon Monox..	0.9672	.07806	12.82	55.14	.2425	.1716	1.415	2.65
Coal { from.....	0.320	.02583	38.71	166.68	.....	.....	.....	54.88
Gas { to.....	0.740	.05973	16.74	72.08	.....	.....	.....	20.98
Helium.....	0.1368	.01104	90.58	362.0	2.3280	1.3968	1.667	69.67
Hydrogen.....	0.0696	.00562	177.94	770.4	3.4056	2.4147	1.410	75.09
Methane.....	0.5576	.04500	22.12	96.44	.5929	.4689	1.265	35.71
Neon.....	0.6963	.05620	17.79	76.60	.....	.....	.....	.....
Nitrogen.....	0.9673	.07807	12.81	55.10	.2436	.1727	1.410	2.64
Oxygen.....	1.1053	.08921	11.21	48.256	.2173	.1552	1.400	.....

The above data are given for 32° F. and 29.92" hg.

Reference: Smithsonian Physical Tables.

TABLE II. HYDROGEN

Pure Dry Gas in Dry Air.

Lifts in lbs. per 1000 cu. ft.

Pressure Inches Hg	30.00	29.92	29.00	28.00	26.00	24.00	22.00	20.00	18.00
Temp. of °F									
-20	83.26	83.04	80.46	77.70	72.16	66.61	61.05	55.51	49.96
-10	81.73	81.51	78.99	76.27	70.84	65.38	59.93	54.49	49.04
0	80.19	79.98	77.52	74.84	69.50	64.15	58.80	53.46	48.11
10	78.68	78.45	76.04	73.41	68.17	62.93	57.68	52.44	47.20
20	77.10	76.89	74.51	71.95	66.82	61.68	56.54	51.40	46.26
30	75.61	75.41	73.07	70.56	65.53	60.48	55.44	50.41	45.37
32	75.29	75.09	72.76	70.26	65.25	60.23	55.21	50.20	45.17
40	74.06	73.86	71.59	69.12	64.19	59.25	54.31	49.37	44.44
50	72.53	72.34	70.11	67.69	62.86	58.02	53.19	48.36	43.52
60	71.00	70.81	68.62	66.26	61.54	56.80	52.06	47.34	42.60
70	69.47	69.28	67.15	64.84	60.21	55.58	50.94	46.32	41.68
80	67.91	67.73	65.63	63.38	58.86	54.33	49.80	45.28	40.75
90	66.41	66.23	64.18	61.98	57.56	53.13	48.70	44.28	39.86
100	64.88	64.71	62.72	60.55	56.23	51.90	47.58	43.26	38.93
110	63.34	63.17	61.23	59.12	54.89	50.67	46.45	42.23	38.00
120	61.81	61.64	59.75	57.69	53.57	49.45	45.33	41.21	37.09

TABLE III. HELIUM

Pure Dry Gas in Dry Air.

Lifts in lbs. per 1000 cu. ft.

Pressure Inches Hg	30.00	29.92	29.00	28.00	26.00	24.00	22.00	20.00	18.00
Tem. of °F									
-20	77.25	77.04	74.68	72.10	66.95	61.80	56.65	51.50	46.35
-10	75.83	75.63	73.30	70.77	65.72	60.66	55.61	50.56	45.50
0	74.41	74.21	71.93	69.45	64.49	59.53	54.56	49.61	44.65
10	72.98	72.79	70.54	68.11	63.25	58.38	53.52	48.66	43.79
20	71.54	71.35	69.16	66.77	62.00	57.23	52.46	47.70	42.92
30	70.15	69.96	67.81	65.47	60.80	56.12	51.44	46.77	42.09
32	69.86	69.67	65.53	65.20	60.55	55.89	51.23	46.58	41.92
40	68.72	68.54	66.43	64.14	59.56	54.98	50.39	45.82	41.23
50	67.30	67.12	65.06	62.81	58.33	53.84	49.35	44.87	40.38
60	65.88	65.70	63.69	61.49	57.10	52.70	48.31	43.92	39.53
70	64.50	64.33	62.35	60.20	55.90	51.60	47.30	43.00	38.70
80	63.04	62.87	60.94	58.84	54.64	50.43	46.23	42.03	37.82
90	61.62	61.46	59.57	57.51	53.41	49.30	45.18	41.08	36.97
100	60.20	60.04	58.20	56.18	51.18	48.16	44.14	40.14	36.12
110	58.77	58.61	56.81	54.85	50.94	47.02	43.10	39.18	35.26
120	57.34	57.19	55.43	53.52	47.90	45.87	42.05	38.23	34.40

CHAPTER VII

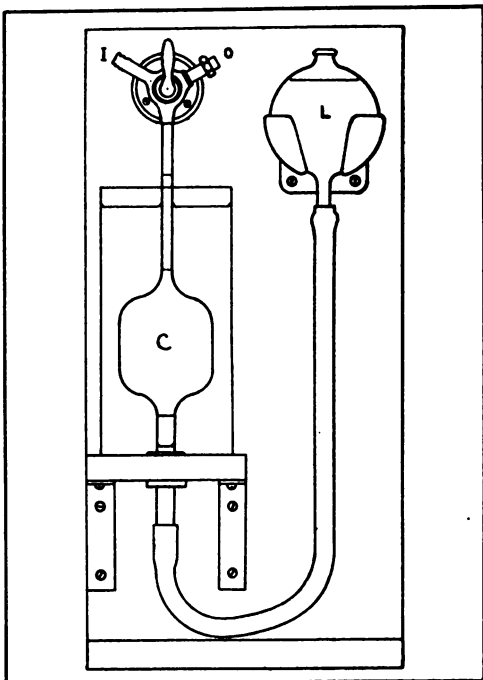
METHOD OF TESTING BALLOON GAS.

By Junius David Edwards.

This report was prepared at the Bureau of Standards for the National Advisory Committee for Aeronautics.

In the generation, storage, and use of hydrogen for balloon purposes it is necessary to be able to determine, first, its lifting power, and secondly, its purity. The lifting power may be determined directly from the specific gravity. Contamination by other gases may be determined by analysis for oxygen, carbon dioxide, etc., by the usual methods of gas analysis. The determination of oxygen is important, since the presence of oxygen in amounts beyond certain limits will make the compressing, handling, and use of the gas particularly hazardous. If the specific gravity of the gas is known, however, it may not be necessary to analyze the gas for oxygen and other gases, because the specific gravity itself is a delicate criterion of the purity of hydrogen.

The effusion method of determining the specific gravity of a gas is probably the simplest method available. It is based upon the fact that the times of escape of equal volumes of two gases through the same small orifice are approximately proportional to the square roots of the densities of the two gases. This



method has been extensively investigated by the author and the full details of this work are given in the Bureau of Standards Technologic Paper No. 94 on the "Effusion method of determining gas density." It was shown in this report that the effusion apparatus as commonly made and used may give very inaccurate results, particularly when used with hydrogen, since hydrogen shows the largest errors of any of the common gases when tested by this method. The limitations of this method were pointed out and the principles which should govern the construction of satisfactory apparatus were demonstrated.

With this work as a basis, the Bureau of Standards designed a simple portable apparatus for testing hydrogen. The novelty lies not so much in the general form of the apparatus but in the size and shape of its various parts, particularly the orifice, which are selected empirically to give a close approximation to the correct result.

Description of apparatus.—The general plan of the apparatus is shown in Figure 1, which is approximately one-fourth size. The apparatus consists of a gas chamber (c) connected by a rubber tube at the bottom to a movable reservoir (L) which may be held at a fixed height in a support, as shown. The volume of gas whose effusion time is to be measured is defined by marks on the tubes just above and below the gas chamber. The gas chamber is surrounded by a water jacket, to keep it at a constant temperature, and is connected at the top to a three-way cock, which permits it to be connected with either the gas inlet (I) on the left or the tube (O), containing the orifice, on the right. By lowering the reservoir (L) and connecting the gas chamber with the gas inlet through the three-way cock a sample of gas may be drawn into the gas chamber; the cock is then closed and the reservoir replaced on its support. The effusion time is obtained by connecting the gas chamber with the orifice and measuring, with a stop watch, the time of passage of the water meniscus between the two marks. In brief, the method of making a test is to measure the time required for the measured volume of air to flow through the orifice under the pressure of the head of water in the reservoir, and then to measure the time required for the same volume of the hydrogen to flow through the orifice. The operating details and precautions to be observed are explained in detail in Technologic Paper No. 94, previously referred to.

Certain features of the design are essential to securing satisfactory results. The orifice itself is the most important part of the apparatus. It is made in a stiff platinum-iridium plate, 0.04 millimeter in thickness. The orifice is 0.25 millimeter in diameter and is made by a small punch and die. The edges of the orifice are

the side of the plate through which the punch entered are necessarily somewhat rounded. The edges on the other side are polished down quite sharp on very fine emery paper. The orifice is then sealed into a glass tube, which is cemented into the metal holder. It is absolutely essential that the orifice be attached in such a position that the sharp-edged entrance of the orifice be on the side toward the effusing gas. If the entrance to the orifice is appreciably rounded, the apparent specific gravity of hydrogen as determined with it will probably be high.

Very low effusion pressures at which the largest errors occur, are avoided by placing the leveling bulb some distance above the gas chamber. The three-way cock is made of metal to avoid breakage; the barrel is made large and accurately machined to prevent leaks and for convenience in setting. A pin is arranged to stop the cock always in exactly the same position when connecting the gas chamber with the orifice.

Calculation of specific gravity. The specific gravity of a gas may be defined as the ratio of the weight of a given volume of gas to the weight of an equal volume of air measured at the same temperature and pressure. The specific gravity of a dry gas referred to dry air is, for all practical purposes, the same for any temperature. But the specific gravity of dry hydrogen compared with dry air is always different from the specific gravity of saturated hydrogen referred to saturated air. Moreover, the latter value is different at different temperatures and pressures.

The specific gravity of the hydrogen under the conditions of test is the ratio of the square of the time for hydrogen effusion to the square of the time for air effusion, i. e.,

$$S_s = \left[\frac{t_H}{t_A} \right]^2 \quad (1)$$

The following equations show the relation between the specific gravities of saturated hydrogen compared with saturated air and the specific gravity of dry gas referred to dry air. The derivation of these formulae is given in Technologic Paper 94.

$$S_s = \frac{(S+k)}{(1+k)} \quad (2)$$

$$S = S_s (1+k) - k \quad (3)$$

S = Specific gravity of dry gas referred to dry air.

S_s = Specific gravity of saturated hydrogen referred to saturated air.

The values of k for gas at 760 millimeters' pressure, and at various temperatures are as follows:

Table I—Values of k at 760 Millimeters and Various Temperatures

Temperature °C	k
0	.004
5	0.005
10	.008
15	.011
20	.015
25	.020
30	.027

Either the lifting power or the purity can be calculated from the specific gravity of the gas. If the purity is to be calculated, some assumption must be made as to the composition of the contaminating gases. It is usually satisfactory to assume that the contamination is air unless there is reason to believe otherwise. The purity can then be calculated from the specific gravity by means of equation 4.

$$\text{Purity (per cent hydrogen)} = 107.51 (1-S) \quad (4)$$

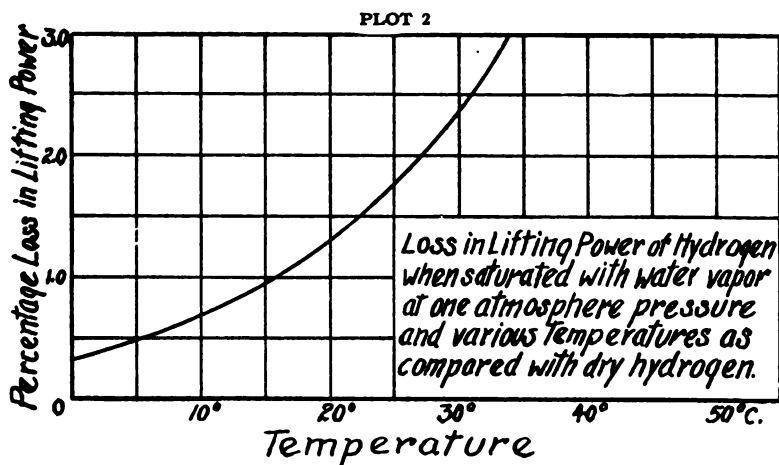
If the purity of the gas contained in an inflated envelope is to be estimated from a determination of the oxygen content, it is usually incorrect to assume that the impurity is air, because rubber is more permeable to oxygen than nitrogen, and the air which penetrates the fabric (Bureau of Standards Technologic Paper No. 113, p. 25) is richer in oxygen than the atmosphere. Consequently the total impurity, oxygen and nitrogen, would be less than corresponded to air of the same oxygen content. Because of the small difference in the densities oxygen and nitrogen this factor can be neglected in calculating the purity from the specific gravity. However, it may make the purity calculated from the oxygen content as much as 5 to 10 per cent low.

Accuracy of method.—With reasonable care in the operation of the apparatus successive determinations should agree within 0.1 to 0.2 per cent hydrogen. The per cent hydrogen as calculated from the specific gravity is usually within 0.2 to 0.3 of the correct figure. The method of making the orifices has resulted in great uniformity and the performance of different pieces of apparatus is correspondingly satisfactory.

APPENDIX

Note on the effect of water vapor in hydrogen upon the lifting power of the gas.

In connection with the discussion of the purity of hydrogen it is interesting to note the effect of water vapor upon the lifting power of hydrogen. The specific gravities of hydrogen and water vapor are 0.0695 and 0.622. The reduction in lifting power of hydrogen



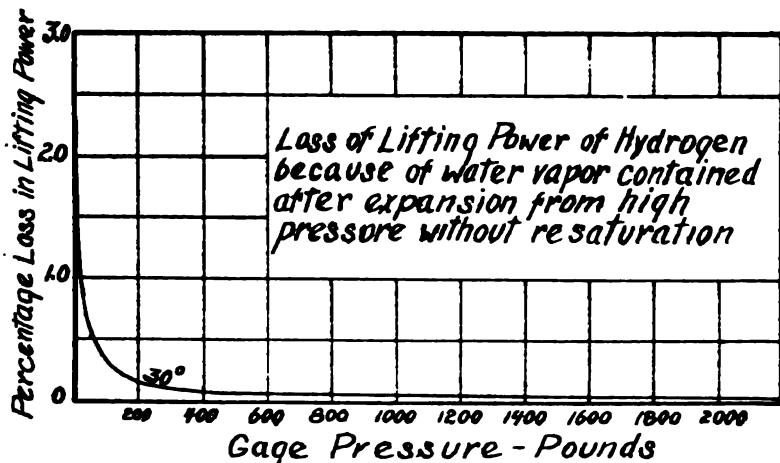
when saturated with water vapor at different temperatures is shown by plot 2.

If hydrogen is compressed in cylinders and the cylinders contain some water in the liquid form, then the hydrogen will be saturated with water vapor at the temperature of the cylinder and each volume of the high-pressure hydrogen will contain the same volume of water vapor as it would if under a pressure of one atmosphere and at the same temperature; hence when it is withdrawn from the cylinder and expanded to the lower pressure it contains only a relatively small amount of water vapor per unit volume. The gas is, therefore, comparatively dry if it has been expanded from a high pressure. The magnitude of the loss in drifting power at one temperature (30° C.) and different pressures is shown in plot 3. The data in plot 3 are computed on the assumption that the gas

will be expanded from the high pressure to atmospheric pressure without either mechanical entrainment of liquid water that may be in the high-pressure container or absorption of water vapor from this liquid during the period of expansion of the gas.

In considering the advantages of using dry hydrogen for inflating balloons the fact should not be overlooked that rubberized balloon fabrics are somewhat permeable to water vapor.

PLOT 3



Therefore, even though the gas is put into the balloon dry it will become partially saturated with water vapor which penetrates the fabric and will ultimately approximate the moisture condition of the surrounding atmosphere.



SECTION SIX

Chapter I	Glossary
Chapter II	Rules of the Air
Chapter III	Available Governmental Publications on Aeronautics
	Index
	Advertisements



CHAPTER I

GLOSSARY

Taken From Report No. 91, Nomenclature for Aeronautics
National Advisory Committee for Aeronautics.

Aircraft are classified as to use or ownership as follows:

STATE aircraft include (a) military aircraft, and (b) aircraft exclusively employed in State service, such as posts, customs, police.

COMMERCIAL aircraft include aircraft used for the purpose of any profession, trade or business when one or more persons (in addition to the pilot and other necessary members of a crew) or freight are carried for hire or reward.

PRIVATE aircraft include all aircraft not **STATE** or **COMMERCIAL**.

NOTE: The following definitions are taken from Report No. 91, Nomenclature for Aeronautics by the National Advisory Committee for Aeronautics.

AEROFOIL—A winglike structure, flat or curved, designed to obtain reaction upon its surfaces from the air through which it moves.

AERONAUT—The pilot of an aerostat.

AEROSTAT—An aircraft which embodies a container filled with a gas lighter than air and which is sustained by the buoyancy of this gas; e. g., airship, balloon.

AEROSTATION—The operation of balloons and airships. Corresponds to aviation (q. v.), but refers to lighter-than-air craft.

AILERON—A hinged or pivoted movable auxiliary surface of an airplane, usually part of the trailing edge of a wing, the primary function of which is to impress a rolling moment on the airplane.

AIRCRAFT—Any form of craft designed for the navigation of the air—airplanes, airships, balloons, helicopters, kites, kite balloons, ornithopters, gliders, aircraft from Underwriters, etc.

AIRDROME—A field providing facilities for aircraft to land and take off and equipped with hangars, shops, and a supply depot for the storage, maintenance, and repair of aircraft.

AIRPLANE—A form of aircraft heavier than air which obtains support by the dynamic reaction of the air against the wings and which is driven through the air by a screw propeller. This term is commonly used in a more restricted sense to refer to airplanes fitted with landing gear suited to operation from the land. If the landing gear is suited to operation from the water, the term, "seaplane" is used. (See definition.)

AIRSHIP—A form of aerostat provided with a propelling system and with means of controlling the direction of movement.

AIR-SPEED INDICATOR—(See Indicator).

ALTIMETER—An aneroid barometer, mounted on an aircraft, whose dial is marked in feet, yards, or meters.

ANEMOMETER—Any instrument for measuring the velocity or force of the wind.

ANGLE, CRITICAL—The angle of attack at which the flow about an aerofoil changes abruptly, with corresponding abrupt changes in the lift and drag coefficients. An aerofoil may have two or more critical angles, one of which almost always corresponds to the angle of maximum lift.

ANGLE, DIHEDRAL—The main supporting surfaces of an airplane are said to have a dihedral angle when both right and left wings are upwardly or downwardly inclined to a horizontal transverse line. The angle is measured by the inclination of each wing to the horizontal. If the inclination is upward, the angle is said to be positive; if downward, negative. The several main supporting surfaces of an airplane may have different dihedral.

ANGLE, GLIDING—The acute angle which the flight path makes with the horizontal when descending in still air under the influence of gravity alone; i. e., without power from the engine.

ANGLE, LANDING—The angle of attack of the main supporting surfaces of an airplane at the instant of touching the ground in a three-point landing; i. e., the angle between the wing chord and the horizontal when the machine is resting on the ground in its normal position.

ANGLE OF INCIDENCE (in directions for rigging)—In the process of rigging an airplane some arbitrary definite line in the airplane is kept horizontal; the angle of incidence of a wing, or of any aerofoil, is the angle between its chord and this horizontal line, which may be the line of the upper longerons of the fuselage or nacelle or the thrust line.

AVIATOR—The operator or pilot of heavier-than-air craft. This term is applied regardless of the sex of the operator.

BALLONET—A small balloon or compartment within the interior of a balloon or airship to be inflated with air for the purpose of controlling the ascent or descent and for maintaining pressure on the outer envelope so as to prevent deformation.

BALLOON—A form of aerostat deriving its support in the air from the buoyancy of the air displaced by an envelope, the form of which is maintained by the pressure of a contained gas lighter than air, and having no power plant or means of controlling the direction of flight in the horizontal plane. (More specifically called a free balloon.)

Barrage—A small captive balloon, raised as a protection against attacks by airplanes.

Captive—A balloon restrained from free flight by means of a cable attaching it to the earth.

Kite—An elongated form of captive balloon, fitted with tail appendages to keep it headed into the wind, and usually deriving increased lift due to its axis being inclined to the wind. A Caquot Balloon is of this type.

Nurse—A small balloon made of heavy fabric, employed as a portable means for storing gas. Sometimes one is so connected as to automatically allow for the expansion or contraction of the gas in an aerostat when on the ground.

Pilot—A small balloon sent up to show the direction of the wind by observations of its flight with theodolites.

Sounding—A small balloon sent aloft without passengers but with registering meteorological and other instruments.

BALLOON BED—A mooring place on the ground for a captive balloon.

BANK—To incline an airplane laterally. Right bank is to incline the airplane with the right wing down. Also used as a noun to describe the position of an airplane when its lateral axis is inclined to the horizontal.

BAROGRAPH—An instrument used to make a permanent record of variations in barometric pressure. In aeronautics the charts on which the records are made sometimes indicate altitudes directly instead of barometric pressures.

BARREL ROLL—An aerial maneuver in which a complete revolution about the longitudinal axis is made, the direction of flight being approximately maintained.

BASKET—The car suspended beneath a balloon, for passengers, ballast, etc.

BAY—The cubic section of a truss included between two transversely adjacent sets of struts of an airplane. The first bay is the one closest to the plane of symmetry.

BIPLANE—A form of airplane whose main supporting surface is divided into two parts, superimposed.

BULKHEAD—A transverse structural member of a fuselage or nacelle, continuous around the periphery.

CABANE—A pyramidal or prismatic framework to which wire or cable stays are secured.

GLOSSARY

- CAMBER**—The convexity or rise of the curve of an aerofoil from its chord, usually expressed as the ratio of the maximum departure of the curve from the chord to the length of the chord. "Top camber" refers to the top surface of an aerofoil and "bottom camber" to the bottom surface. "Mean camber" is the mean of these two.
- CEILING**—Absolute—The maximum height above sea level which a given aircraft can approach asymptotically, assuming standard air conditions.
Service—The height above sea level at which a given aircraft ceases to rise at a rate higher than a small specified one (100 feet per minute in United States Air Service). This specified rate may be different in the services of different countries.
- CHORD**—Of an Aerofoil Section—The line of a straight edge brought into contact with the lower surface of the section at two points. In the case of an aerofoil having double convex camber the straight line joining the leading and trailing edges. (These edges may be defined, for this purpose, as the two points in the section which are farthest apart.) (Fig. 9.)
- CLIMB. RATE OF**—The vertical component of the air speed of an aircraft; i. e., its vertical velocity with reference to the air.
- CONCENTRATION RING**—Airship—A metal ring to which several rigging lines are brought from the envelope and from which one or more lines also lead to the car.
Free Balloon—A hoop to which are attached the ropes suspending the basket and to which the net is also secured. Also called "load ring."
Parachute—A hoop to which the rigging of the parachute is attached and also the line sustaining the passenger.
- CONSUMPTION PER B. H. P. HOUR**—The quantity of fuel or oil consumed per hour by an engine running at ground level divided by the brake horsepower developed, unless specifically stated otherwise.
- CONTROL COLUMN OR YOKE**—A control lever with a rotatable wheel mounted at its upper end. (See Control stick.) Pitching is controlled by fore-and-aft movement of the column; rolling, by rotation of the wheel. "Wheel control" is that type of control in which such a column or yoke is used.
- CONTROL STICK**—The vertical lever by means of which certain of the principal controls of an airplane are operated. Pitching is controlled by a fore-and-aft movement of the stick, rolling by a side-to-side movement. "Stick control" is that type of control in which such a stick is used.
- COWLING**—The metal covering which houses the engine and sometimes a portion of the fuselage or nacelle as well.
- CROW'S-FOOT**—A system of diverging short ropes for distributing the pull of a single rope.
- DIRIGIBLE**—See airship.
- DIVE**—A steep glide.
- DOPE, AIRPLANE**—A general term applied to the material used in treating the cloth surface of airplane members to increase strength, produce tautness, and act as a filler to maintain air-tightness.
- DRAG**—The component parallel to the relative wind of the total force on an aerofoil or aircraft due to the air through which it moves.
In the case of an airplane, that part of the drag due to the wings is called "wing resistance"; that due to the rest of the airplane is called "structural," or "parasite resistance."
- DRAG ROPE**—The rope dropped by an air-ship in order to allow it to be secured by a landing party.
- DRAG STRUT**—A compression member of the internal bracing system of an aerofoil.
- DRIFT**—The angular deviation from a set course over the earth, due to cross currents of wind; hence, "drift meter."
- DRIFT METER**—An instrument for the measurement of the angular deviation of an aircraft from a set course, due to cross winds.

- DRY WEIGHT**—The weight of an engine, including carburetors, propeller-hub assembly, and ignition system, complete, but excluding exhaust manifolds.
- ENVELOPE**—The outer covering of a rigid airship; or, in the case of a balloon or a nonrigid airship, the bag which contains the gas.
- FACTOR OF SAFETY**—The ratio of the ultimate strength of a member of the maximum possible load occurring under conditions specified.
- FAIRING**—A member whose primary function is to produce a smooth outline and to reduce head resistance or drag.
- FINS**—Small stationary surfaces, substantially vertical, attached to different parts of aircraft, in order to promote stability; for example, tail fins, skid fins, etc. Fins are sometimes adjustable.
- FINS, KITE BALLOON**—The air-inflated lobes intended to keep the balloon headed into the wind.
- FIRE WALL**—A metal plate, so set as to isolate from the engine the other parts of the airplane structure, and this to reduce the risk from a backfire.
- FITTING**—A generic term for any small metal part used in the structure of an airplane.
- FLOAT**—A completely inclosed water-tight structure attached to an aircraft in order to furnish it buoyancy when in contact with the surface of the water. In float seaplanes the crew is carried in a fuselage or nacelle separate from the float.
- FLOTATION GEAR**—An emergency landing gear attached to an airplane, which will permit of safe landing on the water and provide buoyancy when resting on the surface of the water.
- FLYING BOAT**—(See Seaplane).
- FUSELAGE**—The elongated structure, of approximately streamline form, to which are attached the wings and tail unit of an airplane. In general it is designed to hold the passengers.
- GAP**—The shortest distance between the planes of the chords of the upper and lower wings of a biplane, measured along a line perpendicular to the chord of the upper wing at any designated point of its entering edge.
- GAS CELL**—One of the internal gas holding bags of a rigid (Zeppelin type) airship.
- GLIDE, TO**—To descend at a normal angle of attack without engine power sufficient for level flight, the propeller thrust being replaced by a component of gravity along the line of flight.
- GLIDER**—A form of aircraft similar to an airplane, but without any power plant. Gliders are used chiefly for sport.
- HANGAR**—A shelter for housing aircraft.
- HELICOPTER**—A form of aircraft whose support in the air is derived from the vertical thrust of propellers.
- HOG (AIRSHIP)**—A distortion of the envelope in which the axis becomes convex upward or both ends droop.
- HORN**—The operating lever of a control surface of an aircraft, e. g., aileron horn, rudder horn, elevator horn.
- HORSEPOWER OF AN ENGINE, MAXIMUM**—The maximum horsepower which can be safely maintained for periods not less than five minutes.
- HORSEPOWER OF AN ENGINE, NORMAL**—The highest horsepower which can be safely maintained for long periods.
- HULL (SEAPLANE)**—The portion of a boat seaplane which furnishes buoyancy when in contact with the surface of the water, to which the main supporting surfaces and other parts are attached, and which contains accommodations for the crew.
- INCLINOMETER**—Absolute—An instrument giving the attitude of an aircraft with reference to true gravity.
- Relative—An instrument giving the attitude of an aircraft with reference to apparent gravity. Such instruments are sometimes incorrectly referred to as banking indicators.*

INDICATOR, AIR-SPEED—An anemometer mounted on an aircraft for the purpose of indicating the speed of the aircraft.

True air-speed indicator—An instrument, usually working on the principle of the Biram or Robinson anemometers, which gives the true air speed, independent of density.

Apparent Air-speed indicator—An instrument, usually dependent on pressure measurements, the readings of which vary with the density of the air.

LAMINATED WOOD—Wooden parts made up by gluing or otherwise fastening together individual wood planks or laminations with the grain substantially parallel.

LANDING FIELD—A field of such a nature as to permit of airplanes landing or taking off.

LEADING EDGE—The foremost edge of an aerofoil or propeller blade.

LIFT—The component of the total air force which is perpendicular to the relative wind and in the plane of symmetry. It must be specified whether this applies to a complete aircraft or parts thereof. (In the case of an airship this is often called "dynamic lift.")

LOAD—**Dead**—The structure, power plant, and essential accessories of an aircraft. Included in this are the water in the radiator, tachometer, thermometer, gauges, air-speed indicators, levels, altimeter, compass, watch and hand starter, and also, in the case of an aerostat, the amount of ballast which must be carried to assist in making a safe landing.

Full—The total weight of an aircraft when loaded to the maximum authorized loading of that particular type.

Useful—The excess of the full load over the dead load of the aircraft itself. Therefore useful load includes the crew and passengers, oil and fuel, ballast, electric-light installation, chart board, detachable gun mounts, bomb storage, and releasing gear, wireless apparatus, etc.

LOAD RING—See concentration ring (balloon).

LONGERON—A fore-and-aft member of the framing of an airplane fuselage or nacelle, usually continuous across a number of points of support.

LOOP—An aerial maneuver in which the airplane describes an approximately circular path in the plane of the longitudinal and normal axes, the lateral axis remaining horizontal, and the upper side of the airplane remaining on the inside of the circle.

MONOCOQUE—A type of fuselage which is constructed by wrapping strips of veneer around formers, and in which the veneer is primarily depended on to carry stresses arising in the fuselage.

MONOPLANE—A form of airplane which has but one main supporting surface extending equally on each side of the body.

MULTIPLANE—A form of airplane whose main supporting surface is divided into four parts' superimposed.

NACELLE—The inclosed shelter for passengers or for a power plant. A nacelle is usually shorter than a fuselage, and does not carry the tail unit.

NOSE HEAVY—The condition of an aircraft in which, in any given condition of normal flight, the nose tends to drop if the longitudinal control is released; i. e., the condition in which the pilot has to exert a pull on the control stick or column to maintain the given condition.

ORNITHOPTER—A form of aircraft deriving its support and propelling force from flapping wings.

OVER-ALL LENGTH—The distance from the extreme front to the extreme rear of an aircraft, including the propeller and the tail unit.

OVERHANG—One-half the difference in the span of any two main supporting surfaces of an airplane. The overhang is positive when the upper of the two main supporting surfaces has the larger span.

PANCAKE, TO—To "level off" an airplane higher than for a normal landing, causing it to stall and descend with the wings at a very large angle of attack and approximately without bank, on a steeply inclined path.

PARACHUTE—An apparatus used to retard the descent of a falling body by offering resistance to motion through the air; usually made of light fabric with no rigid parts.

PERFORMANCE—The maximum and minimum speeds and rate of climb at various altitudes, the time to climb to these altitudes, and the ceiling constitute the performance characteristics of an airplane.

PITCH OF A PROPELLER—Pitch, Aerodynamic. The distance a propeller would have to advance in one revolution in order that the torque might be zero.

Pitch, effective. The distance an aircraft advances along its flight path for one revolution of the propeller.

Pitch, Geometrical. The distance an element of a propeller would advance in one revolution if it were turning in a solid nut; i. e., if it were moving along a helix of slope equal to the angle between the chord of the element and a plane perpendicular to the propeller axis. The mean geometrical pitch of a propeller, which is a quantity commonly used in specifications, is the mean of the geometrical pitches of the several elements.

PITOT TUBE—A tube with an end open square to a fluid stream. It is exposed with the open end pointing upstream to detect an impact pressure. It is usually associated with a coaxial tube surrounding it, having perforations normal to the axis for indicating static pressure; or there is such a tube placed near it and parallel to it, with a closed conical end and having perforations in its side. The velocity of the fluid can be determined from the difference between the impact pressure and the static pressure, as read by a suitable gauge. This instrument is often used to determine the velocity of an aircraft through the air.

PLYWOOD—A product formed by gluing together two or more layers of wood veneer.

POWER, MARGIN OF—The difference between the power available at any given speed and in air of given density and the power required for level flight under the same conditions. The best rate of climb at any altitude depends on the maximum margin of power.

POWER LOADING—The weight per horsepower, computed on a basis of full load and of power in air of standard density unless otherwise stated.

PRESSURE NOZZLE—The apparatus which, in combination with a gauge, is used to measure the pressure due to speed through the air. Includes both Pitot and Venturi tubes. Pressure nozzles of various types are also used in yawmeters and other instruments.

PROPELLER, PUSHER—A propeller which is placed at the rear end of its shaft and pushes against the thrust bearing.

PROPELLER, TRACTOR—A propeller which is placed at the forward end of its shaft and pulls on the thrust bearing.

QUADRUPLANE—A form of airplane whose main supporting surface is divided into four parts, superimposed.

RAKE—The cutting away of the wing tip at an angle so that the main supporting surfaces seen from above will appear of trapezoidal form. The amount of rake is measured by the angle between the straight portion of the wing-tip outline and the plane of symmetry. The rake is positive when the trailing edge is longer than the leading edge.

RATE OF CLIMB—The vertical component of the air speed of an aircraft; i. e., its vertical velocity with reference to the air.

RATE-OF-CLIMB INDICATOR—An instrument indicating the vertical component of the velocity of an aircraft. Most rate-of-climb meters depend on the rate of change of the atmospheric pressure.

RELATIVE WIND—The motion of the air with reference to a moving body. Its direction and velocity, therefore, are found by adding two vectors, one being the velocity of the air with reference to the earth, the other being equal and opposite to the velocity of the body with reference to the earth.

REVERSE TURN—A rapid maneuver to reverse the direction of flight of an airplane, made by a half loop and half roll in either sequence.

REVOLUTIONS, MAXIMUM—The maximum number of revolutions per minute that may be maintained for periods not less than 5 minutes.

REVOLUTIONS, NORMAL—The highest number of revolutions per minute that may be maintained for long periods.

RIGHT-HAND ENGINE—An engine the final power delivery shaft of which rotates clockwise when viewed by an observer looking along the engine toward the power delivery end.

- RIGHTING MOMENT**—A moment which tends to restore an aircraft to its previous attitude after any small rotational displacement.
- RIP CORD**—The rope running from the rip panel of a balloon or nonrigid airship to the basket, the pulling of which tears off the rip panel and causes immediate deflation.
- RUDDER**—A hinged or pivoted surface used for the purpose of impressing yawing moments on an aircraft; i. e., for controlling its direction of flight.
- RUDDER BAR**—The foot bar by means of which the rudder is operated.
- RUDDER TORQUE**—The twisting effect exerted by the rudder on the fuselage, due to the relative displacement of the center of pressure of the rudder. The product of the rudder area by the distance from its center of area to the center line of the fuselage may be used as a relative measure of rudder torque.
- SEAPLANE**—A particular form of airplane designed to rise from and land on the water.
- Boat Seaplane, or Flying Boat—A form of seaplane having for its central portion a boat which provides flotation. It is often provided with auxiliary floats or pontoons.
- Float Seaplane. A form of seaplane in which the landing gear consists of one or more floats or pontoons.
- SHOCK ABSORBER**—A spring or elastic member, designed to prevent the imposition of large accelerations on the fuselage, wings, and other heavy concentrated weights. Shock absorbers are usually interposed between the wheels, floats, or tail skid, and the remainder of the airplane to secure resiliency in landing and taxi-ing.
- SHUTTERS**—The adjustable blinds or vanes which are used to control the amount of air flowing through the radiator and so to regulate the temperature of the cooling water.
- SIDE SLIPPING**—Sliding with a component of velocity along the lateral axis which is inclined and in the direction of the lower end of that axis. When it occurs in connection with a turn it is the opposite of skidding. (q. v.)
- SKIDDING**—Sliding sidewise away from the center of curvature when turning. It is usually caused by banking insufficiently and is the opposite of side slipping. (q. v.)
- SKIDS**—Runners used as members of the landing gear and designed to aid the aircraft in landing or taxi-ing.
- SKIN FRICTION**—The tangential component of the fluid force at a point on a surface. It depends on the viscosity and density of the fluid, the total area and the roughness of the surface of the object.
- SLIP**—The difference between the effective pitch and the mean geometrical pitch. Slip is usually expressed as a percentage of the mean geometrical pitch.
- SLIP STREAM**—The stream of air behind a propeller.
- SOAR, TO**—To fly without engine power and without loss of altitude. Lightly loaded gliders will soar in rising currents of air.
- SPAN, OR SPREAD**—The maximum distance laterally from tip to tip of an airplane inclusive of ailerons, or the lateral dimensions of an aerofoil.
- SPEED—Air**—The speed of an aircraft relative to the air.
- Ground—The horizontal component of the velocity of an aircraft relative to the earth.
- SPEED, MINIMUM**—The lowest speed which can be maintained in level flight, with any throttle setting whatever.
- SPEED, PITCH**—The product of the mean geometrical pitch by the number of revolutions of the propeller in unit time; i. e., the speed the aircraft would make if there were no slip.
- SPIN**—An aerial maneuver consisting of a combination of roll and yaw, with the longitudinal axis of the airplane inclined steeply downward. The airplane descends in a helix of large pitch and very small radius, the upper side of the airplane being on the inside of the helix, and the angle of attack on the inner wing being maintained at an extremely large value.

SPIRAL INSTABILITY—The instability on account of which an airplane tends to depart from straight flight, by a combination of side slipping and banking, the latter being always too great for the turn.

SPREAD—(See Span).

STABILITY—Static Stability—A machine is statically stable if, when slightly displaced by rotation about its center of gravity (as in wind tunnel experimentation), moments come into play which tend to return the machine to its normal attitude.

Dynamical Stability—A machine is dynamically stable if, when displaced from steady motion in flight, it tends to return to that steady state of motion.

In a general way, the difference between static stability and dynamical stability is that the former depends on restoring moments and the latter on damping factors.

Automatic—Stability dependent upon movable control surfaces. The term "automatic stability" is usually applied to those cases in which the control surfaces are automatically operated by mechanical means.

Directional—Stability with reference to rotations about the normal axis; i. e., a machine possessing directional stability in its simplest form is one for which N_v is negative. Owing to asymmetry, directional stability is closely associated with lateral stability.

Inherent—Stability of an aircraft due solely to the disposition and arrangement of its fixed parts; i. e., that property which causes it, when disturbed, to return to its normal attitude of flight without the use of the controls or the interposition of any mechanical device.

Lateral—Stability with reference to disturbances involving rolling, yawing, or side-slipping; i. e., disturbances in which the position of the plane of symmetry of the aircraft is affected. Longitudinal—Stability with reference to disturbances in the plane of symmetry; i. e., disturbances involving pitching and variations of the longitudinal and normal velocities.

STABILIZER—(See Tail plane).

STABILIZER, MECHANICAL—A mechanical device to stabilize the motion of an aircraft. Includes gyroscopic stabilisers, pendulum stabilisers, inertia stabilisers, etc.

STAGGER—The amount of advance of the entering edge of an upper wing of a biplane, triplane, or multiplane over that of a lower, expressed as percentage of gap. It is considered positive when the upper wing is forward and is measured from the entering edge of the upper wing along its chord to the point of intersection of this chord with a line drawn perpendicular to the chord of the upper wing at the entering edge of the lower wing, all lines being drawn in a plane parallel to the plane of symmetry.

STALLING—A term describing the condition of an airplane which from any cause has lost the relative air speed necessary for control.

STATIC THRUST—The thrust developed by a propeller when the aircraft is held stationary on the ground.

STATOSCOPE—An instrument to detect the existence of minute changes of atmospheric pressure, and so of small vertical motions of an aircraft.

STEP—A break in the form of the bottom of a float or hull designed to assist in securing a dynamic reaction from the water.

STRAND—A species of wire made up of several individual wires twisted together. (There are usually 19 wires—a single wire as core, an inner layer of 6 wires, and an outer layer of 12.)

STREAMLINE—The path of a small portion of a fluid, supposed continuous, commonly taken relative to a solid body with respect to which the fluid is moving. The term is commonly used only of such paths as are not eddying, but the distinction should be made clear by the context.

STREAMLINE FLOW—The condition of continuous flow of a fluid, so distinguished from eddying flow.

STREAMLINE FORM—A fair form intended to avoid eddying and to preserve streamline flow.

- STRUT**—A member of a truss frame designed to carry compressive loads. For instance, the vertical members of the wing truss of a biplane (interplane struts) and the short vertical and horizontal member separating the longerons (q. v.) in the fuselage.
- SURFACE**—An aerofoil used for sustentation or control or to increase stability. Applies to the whole member, and not to one side only.
- Balanced**—A surface, such as a rudder, aileron, etc., part of which is in front of its pivot.
- SWEEP BACK**—The angle, measured in a plane parallel to the lateral axis and to the chord of the main planes, between the lateral axis of an airplane and the entering edge of the main planes.
- TAIL HEAVY**—The condition of an aircraft in which, in any given condition of normal flight the nose tends to rise if the longitudinal control is released; i. e., the condition in which the pilot has to exert a push on the control stick or column to maintain the given condition.
- TAIL PLANE**—A stationary horizontal, or nearly horizontal, tail surface, used to stabilize the pitching motion. Often called "stabilizer."
- TAIL SLIDE**—The rearward motion which certain airplanes may be made to take after having been brought into a stalling position.
- TAIL UNIT**—The tail surfaces of an aircraft.
- TAXI, TO**—To run an airplane over the ground, or a seaplane on the surface of the water, under its own power.
- TRAIL ROPE**—The long trailing rope attached to a spherical balloon, to serve as a brake and as a variable ballast.
- TRAILING EDGE**—The rearmost edge of an aerofoil or propeller blade.
- TRIPLANE**—A form of airplane whose main supporting surface is divided into three parts, superimposed.
- TURN INDICATOR**—An instrument showing when the direction of the line of flight or the direction of the projection of that line on a horizontal plane is altering, and in its more refined forms, giving the rate of turn, in terms either of the angular velocity or of the radius of curvature.
- VENTURI TUBE**—A short tube with flaring ends and a constriction between them, so that when fluid flows through it, there will be a suction produced in a side tube opening into the constricted throat. This tube, when combined with a Pitot tube or with one giving static pressure, forms a pressure nozzle, which may be used as an instrument to determine the speed of an aircraft through the air.
- WARP, TO**—To change the form of a wing by twisting it. Warping is sometimes used to maintain the lateral equilibrium of an airplane.
- WASH**—The disturbance in the air produced by the passage of an aerofoil.
- WASHIN**—A permanent increase in the angle of attack near the tip of the wing.
- WASHOUT**—A permanent decrease in the angle of attack near the tip of the wing.
- WIND TUNNEL**—An elongated inclosed chamber, including means for the production of a substantially steady air current through the chamber. Models of aircraft or other objects are supported in the center of the airstream and their resistance and other characteristics when exposed to an air current of known velocity are determined. The term includes those laboratories in which, as in the Eiffel type, there is an experimental chamber of much larger cross-section than the air current.
- WINDMILL**—A small air-driven turbine with blades similar to those of a propeller exposed on an aircraft, usually in the slip stream, and used to drive such auxiliary apparatus as gasoline pumps and radio generators.
- WING**—The portion of a main supporting surface of an airplane on one side of the plane of symmetry; e. g., a biplane has four wings.
- WING LOADING**—The weight carried per unit area of supporting surface. The area used in computing the wing loading should include the ailerons, but not the tail plane or elevators.

WING RIB—A fore-and-aft member of the wing structure of an airplane, used to give the wing section its form and to transmit the load from the fabric to the spars.

Rib, compression—A heavy rib designed to have the above functions and also to act as a strut opposing the pull of wires in the internal drag truss.

Rib, form—An incomplete rib, frequently consisting only of a strip of wood extending from the leading edge to the front spar, which is used to assist in maintaining the form of the wing where the curvature of the aerofoil section is sharpest.

WING SPARS—The principal transverse structural elements of the wing assembly of an airplane. The load is transmitted from the ribs to the spars, and thence to the lift and drag trusses.

WING TRUSS—The framing by which the wing loads of an airplane are transmitted to the fuselage; comprises struts, wires, or tie-rods, and spars.

WIRE—In aeronautics refers specifically to hard-drawn solid wire.

WIRES, ANTIDRAG—Wires designed primarily to resist forces acting parallel to the planes of the wings of an airplane and in the same direction as the direction of flight.

WIRES, ANTILIFT—Wires in an airplane intended mainly to resist forces in the opposite direction to the lift, and to oppose the lift wires and prevent distortion of the structure by overtightening of those members.

WIRES, LIFT—The wires which transmit the lift on the outer portion of the wings of an airplane in toward the fuselage or nacelle. These wires usually run from the top of an interplane strut to the bottom of the strut next nearer the fuselage.

WIRES, STAGGER—Wires connecting the upper and lower surfaces of an airplane, and lying in planes substantially parallel to the plane of symmetry.

YAWING—Angular motion about the normal axis.

ZOOM, TO—To climb for a short time at an angle greater than that which can be maintained in steady flight, the machine being carried upward at the expense of its stored kinetic energy. This term is sometimes used by pilots to denote any sudden increase in the upward slope of the flight path.

CHAPTER II

RULES OF THE AIR

In the absence of Federal Legislation, we have taken the Underwriters' Laboratories "Rules of the Air" compiled from the Air Regulations of Canada and the Convention relating to Air Navigation of the Peace Conference.

General Rules

1. Nothing in these rules shall exonerate any aircraft, or the owner, pilot or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of the air, or by the special circumstances of the case. (I. C. D-50.)*
2. Nothing in these rules shall interfere with the operation of any special rule or rules duly made and published relative to navigation of aircraft in the immediate vicinity of any aerodrome or other place and it shall be obligatory on all owners, pilots, or crews of aircraft to obey such rules. (I. C. D. 51.)
3. The term "risk of collision" shall include risk of injury due to undue proximity of other aircraft. Every aircraft that is required by these rules to give to another to avoid collision shall keep a safe distance, having regard to the circumstances of the case. (I. C. D-24; C-66.)
4. In obeying and construing these rules, due regard shall be had to all dangers of navigation and collision and to any special circumstances which may render a departure from the rules necessary in order to avoid immediate danger. (I. C. D-34.)
5. Every aircraft in a cloud, fog, mist or other condition of bad visibility shall proceed with caution, have careful regard to existing circumstances and conditions. (I. C. D-33.)
6. Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing and angle of elevation of an approaching aircraft. If neither the compass bearing nor the angle of elevation appreciably change, such risk shall be deemed to exist. (I. C. D -23; C-65.)

Right of Way

7. Airplanes shall always give way to balloons and airships, whether fixed or free. Airships shall always give way to balloons. (I. C. D-21; C-63.)

8. An airship, when not under its own control, shall be classed as a free balloon. (I. C. D-22; C-64.)

9. A motor-driven aircraft must always maneuver, according to these rules, as soon as it is apparent that, if it adhered to its course, it would pass at a distance of less than 600 ft. from any part of any other aircraft. (cf. I. C. D-25; C-67.)

10. Where, by any of these rules, one of two aircraft is to keep out of the way, the other shall hold to its course and speed, except when in consequence of thick weather or other causes the aircraft having the right of way shall find itself so close that collision cannot be avoided by the action of the giving-away craft alone, then the aircraft having right of way shall take such action as will best aid to avert collision. (cf. I. C. D-29; C-71.)

*Parenthetical references following these rules show the paragraph numbers of corresponding rules in Annex D of the International Convention and in the Air Regulations of Canada.

Pass to the Right

11. When two motor-driven aircraft approach head-on, or nearly head-on, each shall alter its course to the right, (I. C. D-26; C-68.)

When Courses Cross

12. When two motor-driven aircraft are on courses which cross, the air craft which has the other on *its own right side shall keep out of the way of the other.* (I. C. D-27; C-69.)

Overtaking Aircraft Responsible

13. An aircraft overtaking any other aircraft shall keep out of the way of the overtaken aircraft by altering its course to *the right*, and shall not pass by diving. (I. C. D-28; C-70 (1).)

14. Every aircraft coming up with another aircraft from any direction more than 110 deg. from directly ahead of the latter shall be deemed to be an overtaking aircraft, and no subsequent alteration of bearing between the two aircraft shall make the overtaking aircraft a crossing aircraft within the meaning of these rules, or relieve it of the duty of keeping clear of the overtaken aircraft until it is passed and clear. (I. C. D-28; C-70 (2).)

15. As by day the overtaking aircraft cannot always know with certainty whether it is forward or abaft the 110 deg. direction *line from the other aircraft*, it should, if in doubt, assume it is an *overtaking aircraft* and keep out of the way. (I. C. D-28; C-70 (3).)

Airway Courses

16. In following an officially or otherwise recognized air route every aircraft, when it is safe and practicable, shall keep to the right side of such route. (I. C. D-31; C-73.)

Right of Way at Landing Places

17. All aircraft on land and sea about to ascend shall not "take-off" until there is no risk of collision with alighting aircraft. (I. C. D-32; C-74.)

18. Aircraft showing signals of distress shall be given free way in attempting to make a landing on an aerodrome or air-harbor. (I. C. D-43; C-85.)

19. No aircraft shall commence to take-off until a preceding aircraft is clear of the aerodrome or sea-harbor. (I. C. D-45; C-88.)

20. Every airplane when taking off or alighting on an aerodrome, shall do so up-wind. (cf. I. C. D-41; cf. C-82.)

21. In the case of aircraft approaching aerodromes or sea-harbors for the purpose of landing, the aircraft flying at the greater height shall be responsible for avoiding the aircraft at a lower level and as regards landing shall observe the rules for an overtaking aircraft for passing. (cf. I. C. D-42; C-84.)

22. Aircraft alighting or taking-off at aerodromes and sea-harbors shall conform in circling or partial circling to the circuit indicated by the flag or light shown. (I. C. D-36; C-77.)

23. When taking-off, air-craft shall not turn until at least 1,600 ft. beyond the nearest point of the aerodrome or sea-harbor and any turning then made shall be in the direction indicated by the circuit flag or light shown. (I. C. D-37; C-78.)

24. In approaching an aerodrome for alighting and from a distance of at least 1,600 ft. from the leeward side of the alighting zone, the course shall be directly towards such zone and so maintained. (C-79.)

25. In commencing flight the take-off shall be from the extreme leeward point of the taking-off zone. (C-83.)

26. All turning or circling at levels under 6,000 feet, and within 3,500 ft. horizontal distance from any point in an aerodrome or sea-harbor shall be in the direction indicated by the circuit flag or light. (I. C. D-38; C-80.)

Dangerous Flying

27. Acrobatic alighting at public aerodromes is forbidden. (I. C. D-39; C-81.)
28. There shall be no aerial acrobatics within 6,000 ft., in any direction, of a public aerodrome. (I. C. D-39; C-81.)
29. No aircraft shall fly over any city or town below such heights as make it impossible or difficult to alight by gliding outside the city or town. (C-92.)
30. In general no flights shall be made at less than 2,000 ft. above such cities or towns, nor elsewhere, when by reason of low altitude or proximity to persons, or places or objects, public safety is jeopardized. (C-93.)
31. There shall be no trick flying or acrobatics over any city or town area or populous district or over any place where people are gathered for sports or other purposes, except by special permission from the authorities and from the parties promoting such gathering. (C-93.)
32. It is forbidden for anyone to drop or cause or permit to be dropped from any aircraft any article or object capable of causing damage or injury to persons or property, or any ballast except water or fine sand. (I. C. D-35; C-93.)

CHAPTER III

AVAILABLE GOVERNMENTAL PUBLICATIONS ON AERONAUTICS

PART I

The Hydrographic Office, Navy Department, Washington, D. C., have published since November 1st, 1920, a booklet entitled "Notes to Aviators," sent free upon request, which contains a list of landing fields and information concerning them.

Aviators and others interested in aviation who co-operate with this Office by furnishing this information and port facilities for aircraft are placed on the mailing list to receive the Notice to Aviators regularly upon making request by letter to the Hydrographic Office.

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The National Advisory Committee for Aeronautics, 2722 Navy Building, 17th and B. Streets, N. W., Washington, D. C., have compiled and issued the publications listed below which may be procured by applying to the Superintendent of Documents, Government Printing Office, Washington, D. C.

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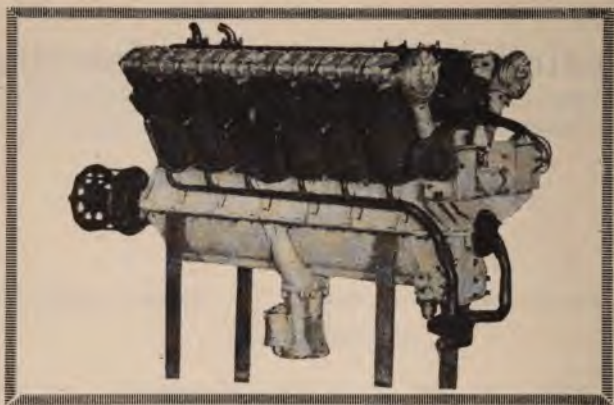
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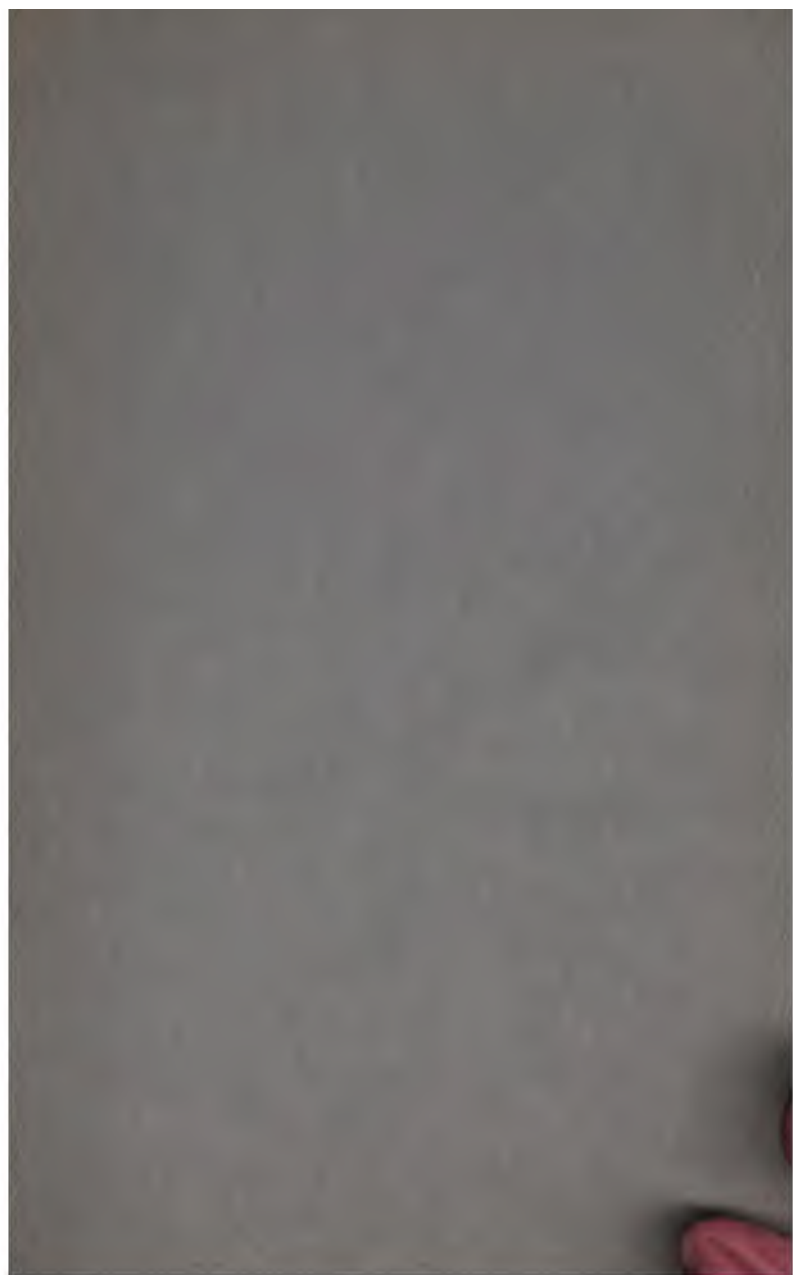
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